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Feeling Hurt: Advances in the Social Psychology of Pain

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Abstract

Pain is a fundamental part of the human condition. It aids survival, indicates threats to bodily integrity, and forms a part of life-transitions and rites of passage from childbirth to death. Pain is experienced within a sociocultural context and attracts a constellation of different meanings – pain as damage, a sign of effort, or pain as cleansing or purifying, such as in religious practice. This thesis advances a novel approach to the human experience of pain as a functional part of our social world. Pain is conceptualised with a biopsychosocial approach, in which pain is seen as more than nociception. Four key frontiers in the social psychological understanding of pain are broached: revisiting how physical pain may relate to the experience of social rejection or ostracism (hurt feelings); how social groups can affect our experience of pain; and how sharing pain and enjoyment can bring us closer to others in our social world – but may also turn others away. I examine these focal areas with a conceptualisation of pain underpinned by the biopsychosocial model, where pain can be viewed as an experience that is biological, psychological, and social in nature, and which must incorporate these key components to be fulsomely understood.

In detail, Chapter 1 introduces the thesis with an overview of the literature along with the aims and scope of the work. Next Chapter 2 is a theoretical chapter which reviews the literature on physical and social pain overlap theory and offers a new synthesis of the relationship between physical and social pain. In essence, the overlap concept binds social pain with the tangibility of physical pain and promises a unified understanding of pain and suffering. However, fMRI evidence now casts doubt on the posited neural basis of overlap. This thesis proposes a conceptualisation of pain overlap that reconnects with the principles of a biopsychosocial approach, and supports recognition of convergence as well as overlap. By unpacking the antecedents, cognitions, and emotions that are associated with each pain, the question of overlap versus difference can be better understood.

Chapters 3 is an empirical examination of how groups can affect our experience of pain. The chapter presents the findings of an fMRI study into the impact of social group memberships on the experience and communication of pain. This research shows fMRI and behavioural evidence that salient group memberships facilitate pain communication. Furthermore, to the extent that people reported more pain in response to salient social groups stimuli, we found corresponding changes in brain activation in areas associated with pain experience (insula and dorsal anterior cingulate cortex). This suggests an adaptive response to pain, whereby modulating pain communication in line with salient group memberships may produce a relative reduction in pain-associated brain activation.

Chapters 4 and 5 turn the spotlight on pleasure and enjoyment alongside pain. These chapters provide field and experimental evidence that sharing pain and enjoyment can help people

feel more connected and serve important identity functions by revealing who we are (Chapter 4), but that pain and pleasure also invite adverse moral judgements (Chapter 5). Chapter 4 presents the findings of a field study at a cold-water mass swim in Tasmania, Australia. Experiencing intense pleasure and pain during the swim was associated with larger increases in self-revelation from pre- to post-swim, which in turn predicted enhanced identification with others over the course of the event. Chapter 5 reports 2 experimental studies with large online samples, in which participants made moral judgements about individuals portrayed to be enjoying pain. Targets who enjoyed pain were consistently considered less moral and more immoral than no-pain controls. These experiments suggest that in unlocking any psychosocial gains from pain and enjoyment, people may also need to be wary of observers' moral judgements.

In sum, this thesis advances theoretical and empirical understanding of pain; by examining how pain may bring benefits, and how pain may influence, and be influenced by, psychosocial factors. Within this research lies an important overarching theme: there are many perspectives on the phenomenon of pain, and social psychology has an important role to play within the broader scientific effort toward understanding pain.

Declaration by Author

This thesis *is composed of my original work, and contains* no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted *to qualify for the award of any* other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications during Candidature

Ferris, L. J., Jetten, J., Molenberghs, P., Bastian, B., & Karnadewi, F. (2016). Increased pain communication following multiple group memberships salience leads to a relative reduction in pain-related brain activity. *PLoS One, 11*(9), e0163117. doi:10.1371/journal.pone.0163117

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Contributor	Statement of contribution
Author Laura Ferris (Candidate)	Wrote the paper (70%) Analysis and visualisation of behavioural data (80%) Edited the paper (70%)
Author Jolanda Jetten	Designed experiments (40%) Analysis of behavioural data (15%) Wrote the paper (15%) Edited paper (10%)
Author Pascal Molenberghs	Designed experiments (40%) Analysis of fMRI data (100%) Wrote the paper (15%) Edited paper (15%)
Author Brock Bastian	Designed experiments (20%) Analysis of behavioural data (15%) Edited the paper (10%)
Author Fika Karnadewi	Collected data (100%) Edited paper (5%)

Contributions by others to the Thesis

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Postgraduate research is known to be challenging, and of course, my PhD has been no exception. When I decided to return to university to start doctoral research, I had an inkling of what might be involved. I was hopeful and cautiously excited about the possibilities for investigating the topic of pain – something I had been experiencing – in scientific, liberating, and creative ways.

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PhD candidature has naturally involved experimentation, mistakes, and no small amount of emotion and consternation. Moments of uncertainty and failures, large and small, accompany the externally observable features of the PhD. But the very best parts come in time – with emerging research success, enduring collaborations, even bigger ideas, and growing confidence in one's own academic voice and place in the academic family.

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Keywords

physical pain, social pain, overlap, social identity, multiple group memberships, pain communication, shared pain, benign masochism, pleasure, morality.

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List of Figures and Tables

List of Abbreviations used in the Thesis

ANOVA – analysis of variance

CI – confidence interval

fMRI – functional magnetic resonance imaging

IASP – International Association for the Study of Pain

OSF – Open Science Framework

On Feeling Hurt: Advances in the Social Psychology of Pain

Chapter 1 Introduction

Pain: Setting the Stage

Pain is a primal and familiar experience – whether from injury, child birth, illness; everyday occurrences or disasters; and the myriad other sources of painfulness that make up the life of a human being. Pain demands our attention, reminds us of our human limitations, and forms the basis of much suffering. It also attracts a certain fascination. For millennia, a chorus of human effort has sought to trace the features of pain, to give voice to its intricacies, through literature, art, religion, science, and philosophy.

Although pain is common and recognisable as a percept (*ouch!*), pain is complex (Auvray, Myin, & Spence, 2010), and our relationship with it has undergone transformational shifts over the centuries (Morris, 1991). Historically the science of pain has been a study of pain mechanism, falling largely within the domain of medicine. With Descartes' famous theorising of the flame-to-brain pathway (1644; see Bourke, 2012), pain was understood as operating through cause and effect mechanisms where pain is an alarm that is directly proportionate to damage to the tissues. This understanding of pain served medical science well for centuries, and forms the basis of the concept of nociception still in use today (Brooks & Tracey, 2005; Duncan, 2000). Significant progress has been made: scientific expansion and refinement of the biological mechanisms of pain has been exponential, supporting theoretical and empirical advancements in pain conceptualisation and treatment (Julius & Basbaum, 2001).

Nevertheless, since the mid-20th century, nothing short of a revolution has taken place in how pain is conceptualised (Melzack & Katz, 2013; Melzack & Wall, 1965; Moayedi & Davis, 2013). Most relevantly for this thesis, biomedical developments have been accompanied by a growing acknowledgment of the psychosocial dimensions of pain, in addition to its biological underpinnings (Fernandez & Turk, 1992; Garland, 2012; Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Morris, 1991; Price, 2000; Sullivan et al., 2001; A. C. de C. Williams & Craig, 2016). These conceptual advances have highlighted the critical role of social psychology with its ontological traditions of scientific concern for cognitions, emotions, and behaviours of the individual and groups. Social psychological examinations of pain thus represent the forefront of this area of research, where much exciting ground is yet to be covered.

Along these lines, this thesis advances a biopsychosocial approach to the human experience of pain. As described further below, the biopsychosocial model originated as a response to the biomedical model of illness (Engel, 1977). As a consequence, its application to pain has often been in service of ways to better treat pain i.e. to assist those suffering from pain, particularly pain not readily encapsulated by medical means (such as chronic or persistent pain, or idiopathic pains:

Melzack & Katz, 2013; Melzack & Wall, 1965; Amanda C de C Williams & Johnson, 2011). However, the biopsychosocial model of pain can offer much more – particularly when applied to consider the positive functions of pain (Bastian, Jetten, Hornsey, & Leknes, 2014).

This thesis therefore places the biopsychosocial theoretical framework into new territory in two ways. First, this thesis examines pain as a *functional* part of our social world. This thesis builds on the expansive gains delivered by the biopsychosocial model, by linking with growing evidence that pain can be functional; for instance, by bringing people together through adversity, enhancing cooperation, coalescing identification with those around us, or allowing us to test our limits (Bastian, Jetten, & Ferris, 2014; Konvalinka et al., 2011; Xygalatas, Konvalinka, Bulbulia, & Roepstorff, 2011; Xygalatas et al., 2013). While pain may not always be positive, a biopsychosocial approach allows for a conceptual shift where pain is considered functional, including its benefits and decrements.

Second, this thesis places the biopsychosocial model of pain in new territory by examining novel topics. These are topics at the heart of social psychological enquiry, such as the impact of groups on the individual, and examining the individual within the collective. This thesis particularly focuses on social contributions to the dynamics of pain – how pain is fundamentally shaped by the psycho*social* as well as the biological; how groups affect pain for the individual, and how pain affects groups and the individuals within them. Specifically, this includes revisiting how physical pain may relate to the experience of social rejection or ostracism (hurt feelings); how salient social groups can affect our experience of pain; and how sharing pain and enjoyment can bring us closer to others in our social world, but may also turn others away. I examine these focal areas with a conceptualisation of pain underpinned by the biopsychosocial model – as an experience that is biological, psychological, and social in nature, and which must incorporate all components in order to be fulsomely understood.

In short, this thesis asks a series of questions – what constitutes pain, and can hurt feelings rightly be conceptualised as 'pain'? Can pain be modulated, for instance by making valued social groups salient? How is it that pain can sometimes be pleasurable, despite its aversiveness – and what are the consequences and implications of this experience? These types of questions cannot be answered without considering the psychological, social and biological basis of this complex human experience. For this reason, the biopsychosocial model deeply informs this thesis and its aims. The next section elaborates on pain definition and measurement, before expanding on the biopsychosocial approach to pain in additional detail.

What Is Pain? Defining and Measuring Pain

Pain is different to other physical sensations in the body (A. D. Craig, 2003b). The International Association for the Study of International Association for the Study of Pain

(1994/2016) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Two key features emerge from this understanding of pain: a) the subjective nature of the pain experience, such that pain may be experienced in terms of tissue damage but absent actual damage; and b) the delineation of its sensory and affective components (Fernandez & Turk, 1992; Price, 2000). This acknowledges pain as an emotional and physical experience; one that is private, subjective and context-dependent; and one that often corresponds to nociceptive input but need not in order to give rise to painfulness.

Biological mechanism. Acknowledging that pain may arise through a range of inputs, physical pain can be biologically understood as originating through detection and transduction of noxious stimuli by nociceptors in the periphery or viscera, with specific and well-characterised receptors for mechanical, thermal, chemical and cold pain. Nociceptive input is received in the dorsal horn of the spinal cord and relayed supraspinally, preserving distinct sensory qualities mapped to the region of detection (Schwarz & Meyer, 2005; Westlund, 2005). Acute physical pain is known to spark specific and complex physiological responses, evinced by increased skin conductance, faster heart rate, and higher levels of blood cortisol, adrenaline and noradrenaline, heralding pain-activation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system (Benarroch & Sandroni, 2005; Pacák & McCarty, 2000). Neuroimaging studies show pain is associated with activity in an extensive subcortical and cortical network, referred to as the pain matrix (Legrain, Iannetti, Plaghki, & Mouraux, 2011; Melzack, 1999, 2005). This network integrates ascending signals and modulates descending feedback, and includes the dorsal anterior cingulate cortex, insula, periaqueductal grey, primary somatosensory cortex and prefrontal cortex (C. R. Chapman, 2005; Coghill, McHaffie, & Yen, 2003; Eisenberger, 2012c; Tracey, 2010).

Predictive biomarkers of the experience of pain are yet to be established, but a graded fMRI signature that correlates with subjective pain ratings has been proposed (Wager, Atlas, Lindquist, Roy, Woo, & Kross, 2013). The extent to which this and similar biological correlates can presently represent multidimensional pain is contested (Miller, 2009), and in some settings, measurement is highly controversial (for example, in determining foetal and neonatal pain: Lee, Ralston, Drey, Partridge, & Rosen, 2005). Consistent with its complex and subjective nature, pain in clinical settings is principally measured through self-report (J. E. Brown, Chatterjee, Younger, & Mackey, 2011).

Pain is a sensation and a motivation. Nociception is not synonymous with pain. Craig (2003b) explains pain as both an interoceptive state (feeling from the body) and homeostatic emotion (affective motivation). In this sense, pain is both a sensation and a complex drive for response – like hunger, thirst or itch, rather than touch (see also, Auvray et al., 2010). This dual nature of pain means that there is both sensory and motivational impetus to mount complex and

adaptive responses that extend beyond simple reflexes (Elwood, Barr, & Patterson, 2009). There are powerful evolutionary incentives to favour a suite of potentially targeted adaptive behaviours over a limited, unitary, or merely reflexive response. Thus an advantage is conferred upon organisms that can experience *pain* as opposed to simply detecting *nociception.*

Pain is socially and culturally informed. Pain is experienced within a sociocultural context, and there are diverse cultural understandings of pain (Aldrich & Eccleston, 2000; Morris, 1991). This also means that experiencing pain attracts a plethora of meanings – pain may signal damage to tissues, but also may represent change in social status through a rite of passage or punishment; symbolising cleansing or purification, such as in religious practice, or impurity or tarnishing via unwanted assault; an indication to stop, or a sign to keep going, as in sustained efforts such as in a triathlon or marathon. Social information can increase pain, such as the knowledge that our pain has been intentionally inflicted by others (Gray & Wegner, 2008). Social support can ameliorate pain, such as during childbirth (Hodnett, Gates, Hofmeyr, & Sakala, 2015), or allow us to tolerate pain longer (Jones & Jetten, 2011). Sociocultural factors may even influence whether or not an experience is deemed pain at all, such as the 'pain' associated with eating capsaicin-rich cuisine (Rozin, Guillot, Fincher, Rozin, & Tsukayama, 2013; Rozin & Schiller, 1980). Therefore, the social element of pain is integral in understanding the pain experience, its sequelae, and its functions.

The Biopsychosocial Model Applied

As highlighted, this thesis takes the biopsychosocial model as its theoretical foundation (Engel, 1977). Now a widely-applied model of transdiagnostic and multidisciplinary significance, it was originally proposed as a model of illness. Through this model, the treating practitioner could engage with the patient as a 'whole person', not merely the measurable biomedical facets of patient disease (Borrell-Carrio, Suchman, & Epstein, 2004). Critically, this model was proposed as an antidote to the very real potential for reductionism and dehumanisation arising from a biomedical frame. Therefore, a biopsychosocial approach meant seeing patients as more than their symptoms – while still recognising and capitalising upon the considerable progress in the treatment of illness delivered by biomedical scientific advances (Gatchel et al., 2007).

Of course, the present work is not the first to take a biopsychosocial approach to pain (see, for example, Fordyce, 1976; Fordyce, Fowler, & DeLateur, 1968; Gatchel et al., 2007; Hadjistavropoulos et al., 2011; Sullivan, 2012; A. C. de C. Williams & Craig, 2016). However, this thesis takes up this approach augmented with the theoretical understandings afforded by the social psychological tradition, to consider where pain may be functional for individuals and groups (*i.e.* possessing functions or serving purposes well beyond those envisaged by a purely 'illness' frame). This allows a broader examination of the benefits *and* decrements associated with pain (Bastian,

Jetten, Hornsey, et al., 2014; Leknes & Bastian, 2014). And as stated earlier, this thesis also advances pain research in new directions by taking up the biopsychosocial approach with a critical eye into previously under-studied corners of pain. Specifically, this thesis critically considers how the biopsychosocial model has paved the way for the field to conceptualise rejection and ostracism as categories of pain. This thesis uses a biopsychosocial understanding of pain to examine how social group memberships can shape how we experience and communicate pain. This thesis also broaches the notion of pleasure with pain, and its psychosocial costs and dividends from the perspective of partaker and observer. Each of these research directions is briefly introduced in the following passages.

'Social' Pain

The concept of pain as a *sensory* and *emotional* experience – one that may not be associated with tissue damage – means that parallels can be drawn between 'feeling hurt' and 'hurt feelings'. Seminal research has highlighted commonalities between the experience of social pain (interpersonal rejection, ostracism, and hurt feelings) and physical pain (Herman & Panksepp, 1978; MacDonald & Leary, 2005; Panksepp, Herman, Conner, Bishop, & Scott, 1978). Over subsequent decades, researchers further considered how these two experiences may be similar, with particular attention directed to uncovering overlap in neural activation patterns in the brain (Eisenberger, 2008, 2012b, 2012c; Eisenberger, 2015; Eisenberger & Lieberman, 2004; Eisenberger, Lieberman, & Williams, 2003; Kross, Berman, Mischel, Smith, & Wager, 2011). Neural evidence of overlap offers a biological index of similarity, potentially even substantiating the view that social and physical pain are the same construct at a biological level. However, this thesis argues that such a conceptualisation of social and physical pain is unsustainable when psychosocial components of pain are considered (such as pain antecedents, pain-related emotions and cognitions, and post-pain behaviours). In short, this is because biological indices alone reduce pain to a discrete biochemical event rather than a subjective phenomenological experience with psychosocial components in tow; and consideration of these psychosocial domains points to differences rather than similarities. The broken heart undoubtedly hurts, but the heart is not truly broken. By considering a contextualised notion of pain – i.e. encapsulating biological indices as well as where pain originated, pain cognitions and affect, and behavioural responses to pain – we can get to a more comprehensive analysis of each pain and understand their differences as well as similarities.

Communicating Pain

Even though pain is an internal experience, intimately unknowable, Glucklich (2003) points out, '[i]t is inconceivable that the suffering of Christ on the cross, or the astounding martyrdom of the saints, or that of Rabbi Akiva or Al-Hallaj, would mean anything to anyone unless pain was intrinsically shareable.' (p. 63). Even though pain is a private, interoceptive experience (Scarry,

1985), it also occurs within a sociocultural context. This context can influence the frequency and duration of pain exposure, cognitions and emotions about pain, and how we communicate pain (Hadjistavropoulos et al., 2011; A. C. de C. Williams & Craig, 2016). Pain communication may be instinctual or reflexive, such as physical withdrawal from noxious stimuli, pain vocalisation, or facial expression. Conveying pain may also be agentic and transactional, in order to draw the attention of others to our circumstances (Hadjistavropoulos et al., 2011).

In addition, the social 'resources' we have at our disposal when in pain appear to influence how pain is experienced. Based on the social identity tradition (Tajfel & Turner, 1979), valued social group memberships represent psychosocial resources that meet fundamental psychological needs and which may be called upon in times of need (Greenaway, Cruwys, Haslam, & Jetten, 2015; S. A. Haslam, Jetten, Postmes, & Haslam, 2009; S. Alexander Haslam, O'Brien, Jetten, Vormedal, & Penna, 2005; Iyer, Jetten, Tsivrikos, Postmes, & Haslam, 2009; Jetten et al., 2015). This means that the salience of social group memberships can also be expected to change how we experience and communicate pain itself (Jones & Jetten, 2011).

In short, communicating pain can allow us to connect to the psychosocial resources we may have at our disposal to alleviate the aversiveness of pain. Making valued group memberships salient may be one way to mobilise these resources, i.e. to elicit pain communication in ways that might alleviate pain. This thesis aims to investigate this proposal empirically. By shining a light on the social dynamics surrounding pain, this line of research demonstrates how the biopsychosocial approach can be utilised to better understand how pain is modulated.

Sharing Pain – and Pleasure

Sharing pain is an intriguing human practice. From a basic evolutionary perspective, the putative function of pain is to capture attentional resources and mobilise action to defend threats or damage to bodily integrity (A. D. Craig, 2003b; Eccleston & Crombez, 1999; Öhman, Flykt, & Esteves, 2001). If pain signals threat and damage, then it follows that avoiding pain is also an important survival tactic: pain's inherent aversiveness ostensibly implies that human beings will always seek to avoid it.

But evidence from cultural, social, and clinical psychology; anthropology; and sociology – not to mention everyday anecdotal experience – readily tells us this is not so (Baumeister, 1989/2014; Bentley, Nock, & Barlow, 2014; Franklin, Puzia, et al., 2013; Nock, 2010; Richert, Whitehouse, & Stewart, 2005; Whitehouse, 1996). Pain may be sought out for social, cultural, or religious reasons (Bridel, 2010; Glucklich, 2003; Mann, Feddes, Doosje, & Fischer, 2015; Xygalatas et al., 2011; Xygalatas et al., 2013), or even simply to alleviate boredom (Wilson et al., 2014).

Psychosocial benefits. Bastian, Jetten, Hornsey, et al. (2014) have persuasively argued that engaging with pain is important in unlocking other benefits beyond threat management. They suggest that pain facilitates pleasure; enables self-regulation; and promotes social bonding; and argue that a host of psychosocial benefits may remain obscured or be only partially realised if we only focus on maximising pleasure and avoiding pain. Thus, engaging in pain together may be one way to access these gains. Indeed, the popularity of collective painful practices, such as cold swims, marathons, and physical challenge events, suggests a side to pain and even enjoyment that is worthy of additional scientific scrutiny. Sharing pain collectively with others promotes cooperation and prosociality (Bastian, Jetten, & Ferris, 2014; Xygalatas et al., 2013). Collective enjoyment and pleasure also binds groups together – referred to as *collective effervescence* or *communitas* (Durkheim, 1912/1995; Páez, Rimé, Basabe, Wlodarczyk, & Zumeta, 2015; E. Turner, 2012; V. W. Turner, 1969/2008). However, the implications of collective pleasure *and* pain together have been less clear. When pain is pleasurable, are these collective effects retained, and what might be the mechanism? Fredrickson (2000) has proposed that peak emotional experiences can provide us with particularly fertile ground for self-knowledge and meaning (see also Whitehouse, 2012). In application, this suggests that intense collective experiences involving pleasure and pain may provide a salient foundation for self-knowledge and revelation as well as connection with others. In its fourth chapter, this thesis examines how pleasure may have a part to play in how such painful practices benefit participants – specifically, whether collective pleasure and pain *together* delivers these benefits.

Moral judgements. The previous section describes social benefits (e.g. group binding) associated with pleasurable pain, which could well lead one to believe that pleasurable pain is desirable as a means to access shared experiences that are rich in meaning and psychosocial benefit. However, it is important to consider the sociocultural context in which these practices and experiences take place. How do others regard those who engage in these experiences? There is ample evidence that pleasurable pain is considered unfavourably by others, but little quantitative work to specifically measure moral judgements when pain and pleasure are manipulated. Moral judgements associated with pain enjoyment are understudied, despite pain enjoyment being an interesting case in which the moral dyad of agent and patient arguably resides within the one entity.

Literary treatment of pain enjoyment has traditionally invoked themes of sub-culture sexuality, particularly deviance and perversion (Allen, 2003; von Sacher-Masoch, 1870/2000). Qualitative evidence from anthropological and sociological fields also points to this notion of dissidence and ‘otherness’ (Baumeister, 1989/2014; Taylor & Ussher, 2001), even though actual prevalence is relatively common (Joyal & Carpentier, 2017). In his works on sexual masochism, Baumeister (1989/2014) noted the need for psychological efforts to understand the phenomenon of

masochism ‘on the basis of common principles in the behaviour of normal people’, rather than as a pathology or deviance (p. x). This thesis aims to unpack moral judgements about those who engage in pleasurable pain, from the perspective of the observer.

In sum, this thesis considers social exclusion with relevance to pain, the effect of valued groups on the experience of pain, the consequences of collective pain enjoyment, and the moral judgements of others concerning this form of benign masochism. Guiding these examinations is the theoretical framework of the biopsychosocial approach to pain. In the following section, the thesis is briefly overviewed by chapter.

Thesis Overview

As noted, this thesis brings a biopsychosocial approach to consider pain as a functional part of our social world. This is done in four substantive chapters – one theoretical chapter, and three chapters presenting empirical research, each described as follows.

In Chapter 2, the biopsychosocial approach is deployed to deliver a new theoretical analysis of the relationship between social and physical pain. For decades, empirical evidence has been mounting that social pain shares key elements with physical pain, such as shared neurochemistry and even neural overlap. Connecting experiences of ostracism, social rejection and hurt feelings with physical pain has in many ways substantiated the experience of social pain in ‘medical’ terms. However, recent neural findings have cast doubt on the notion that the two experiences do indeed share neural overlap (Cacioppo et al., 2013; Woo et al., 2014). These developments make it essential for the field to reconsider what is to be gained by comparisons to physical pain, and what constitutes ‘overlap’. To meet this need, this chapter presents a reconceptualisation of social and physical pain overlap research and makes suggestions to guide the field in moving forward. Ultimately, the experience of social exclusion does not need to be compared with physical pain to demonstrate its veracity as a psychological phenomenon.

Chapters 3, 4 and 5 present empirical work. These chapters focus on physical pain within the social world. Chapter 3 examines the experience and communication of pain in the context of salient social groups, with a laboratory study incorporating fMRI and self-report methodologies. From an evolutionary perspective, eliciting social support is an adaptive response to pain: social support reduces physical pain, and multiple group salience improves pain tolerance (J. L. Brown, Sheffield, Leary, & Robinson, 2003; Jones & Jetten, 2011). Communicating pain to others is a crucial step in securing that social support (Bastian, Jetten, & Ferris, 2014; A. C. Williams, 2002). Therefore, it is important to understand how apparent social resources affect how pain is experienced and communicated. This study showed that participants reported higher levels of pain when more groups were salient. Furthermore, when participants modulated their pain reports according to the number of salient groups, a corresponding relative difference in brain activation

was revealed. This suggests pain communication as an adaptive response to pain in line with fluctuations in salient social resources.

Chapter 4 examines collective painful practices *in vivo* with a field study involving participants undertaking a cold-water mass swim. Consistent with the notion that shared pain promotes social bonding (Bastian, Jetten, & Ferris, 2014), participants showed significantly higher levels of social identification after than before the swim. Contrary to previous evidence of pain and pleasure as a form of self-escape (Baumeister, 1988, 1989/2014), this study found that intense pleasure and pain predicted a greater increase in self-revelation, in turn predicting positive change in social identification over the course of the swim.

Chapter 5 then provides an empirical examination of how pain enjoyment is perceived by others, in particular focusing on moral judgments of observers concerning pain enjoyment. With 2 large-sample studies, this chapter empirically documents the impoverished moral status of those depicted enjoying pain. Together, this thesis is concerned with advancing a social psychology of pain through theoretical and empirical research contributions. On pain, there is still a great deal to discover, and compelling reason to do so.

Chapter 2

Social and physical pain overlap has excited controversy and receives considerable research attention. Although pain overlap research has revealed important insights – linking social pain to the relative tangibility of physical pain, and highlighting the qualities of the pain experience (*qualia*) that feature in both pains – it is now time for critical reflection. There is much to be gained by considering psychological factors beyond these pain *qualia*, such as pain source; thoughts and emotions relating to pain; and behavioural responses to pain. Drawing these factors into a *contextualised* model of pain is critical to understanding what pain means and how people respond to it, and is necessary to bring the field back in step with a biopsychosocial approach to pain. While a lover's rejection may feel like a slap in the face, we must look past the metaphor to reach a more comprehensive psychological analysis of social and physical pain.

Chapter 2 is the manuscript in revision:

Ferris, L. J., et al. (in revision). Feeling hurt: Revisiting the relationship between social and physical pain. *Personality and Social Psychology Review.*

Feeling hurt: Revisiting the relationship between social and physical pain

The physical embodiment of emotional suffering is an enduring symbol. Describing emotional pain in physical terms confers tangibility and corporeality, and there are countless examples in philosophy, literature and religion that bear witness to the association (see MacDonald & Leary, 2005 for review; Morris, 1991). The 'heartache' we experience from the severance of a relationship is real, painful, and it *hurts*.

The notion that these two types of pain represent overlapping states of painfulness is an intuitively powerful progression on this theme. In the last decade there has been a strong push to understand how these pains might be interconnected (see Eisenberger, 2012a, for a review). Striking instances of functional crossover effects have been empirically described, including reports that analgesics can reduce social pain (DeWall et al., 2010; Herman & Panksepp, 1978; *cf* Durso, Luttrell, & Way, 2015), and that social support can reduce physical pain (J. L. Brown et al., 2003; Master et al., 2009). Furthermore, trait sensitivity to physical pain is linked with sensitivity to social pain (Eisenberger, Jarcho, Lieberman, & Naliboff, 2006), and variations in pain receptors predict dispositional sensitivity to social pain (mu-opioid gene receptor polymorphism; Way, Taylor, & Eisenberger, 2009).

Thinking about social and physical pain as overlapping constructs promises a rich and unifying theoretical understanding of human pain and suffering. Overlap is consistent with modern conceptions of pain as a *subjective* unpleasant experience, in which objective nociception may be present but is not required. Examining overlap has thereby brought commonalities into sharp focus. These commonalities link social pain to the relative tangibility of physical pain, giving prominence to the qualities of the pain experience that arise in both pains.

However, we see opportunities to broaden the investigation of physical and social pain by going beyond the *experience* of pain per se to examine a more complex suite of psychological factors. This broader analysis shines a light on other aspects of pain, and factors surrounding pain, which speak to separation *and* overlap – and which can reveal much more about pain itself. In what follows we review the current state of play for the literature on pain overlap, and put forth a basis for the *contextualisation* of pain. This means returning into the frame information about where pain has come from, thoughts and emotions related to why pain is happening and its meaning, and behaviours surrounding painfulness. We present a series of illustrative examples that hint at difference rather than commonality, implying that an overlap frame can limit the scope of inquiry and inadvertently gloss over psychological overlays that add to the conceptual diversity of pain in important ways.

Before beginning our review, we want to make clear that it is not the purpose of this chapter to stipulate where overlap lies, or to quantify the extent to which pain overlap exists. Nor is it about

establishing boundary conditions of pain overlap. Rather, we identify the need for a reframing of the field's approach: away from examining pain qualia alone to an approach that places more focus on the antecedents of pain, and its affective, cognitive and behavioural implications (i.e., a *contextualised* approach). Thinking about pain as more than qualia allows for a genuinely biopsychosocial approach, one that provides an opportunity for new hypotheses to be tested, and for differences between social and physical pain to be illuminated.

What is Pain? 'Hurt Feelings' and Feeling Hurt

Conventional medical notions of pain focused on specificity and positioned pain as a phenomenon arising solely via mechanistic stimulation of receptors in the periphery. René Descartes' enduring image of the flame as pain burns its path from foot to brain (or from body to mind) famously symbolises the bodily machinery of pain from injury-event to painful experience (Bourke, 2012). With the pain-as-nociception model, those pains without an apparent mechanistic aetiology become relegated to 'somatization' (Crombez, Beirens, Van Damme, Eccleston, & Fontaine, 2009), 'psychogenic pain', or in earlier days, hysteria (Cope, 2009); and the lived experience of the person in pain was obscured.

The shift away from a pain-as-nociception model was catalyzed by Melzack and Wall's (1965) gate control theory. This allowed the development of a model of pain in which the brain is an operative component with capacity for descending control of pain inputs, and with psychological factors incorporated as more than mere reactions to pain. Since this turning point, theorists have increasingly recognised that pain can be better understood by looking beyond nociception alone (for instance in cases of chronic pain, phantom limb pain, and other idiopathic pain syndromes; Biro, 2010). It is now widely recognised that pain is a complex, private and subjective experience that is not necessarily contingent on the presence of nociceptive input (Melzack & Katz, 2013): an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage (International Association for the Study of Pain Taskforce on Taxonomy (IASP), 1994/ 2014). At its most famously inclusive, pain is '…whatever the experiencing person says it is, existing whenever the person says it does' (McCaffery, 1968; cited in McCaffery & Beebe, 1994, p. 15). Accordingly, if social pain hurts, then it is *pain*. This is a controversial premise, but one that opened up possibilities to consider the overlap between social and physical pain.

Contemporary pain theory supports a model of pain with two components: sensory and affective (IASP, 1994/2014). In their landmark paper, MacDonald and Leary (2005) characterised social pain as pain affect, suggesting that '…the aversive emotional state of social pain is the same unpleasantness that is experienced in response to physical pain.' (p. 203). They traced the substance of pain overlap across psychological, evolutionary, and neurological domains, and point to the

prevalence of linguistic metaphors describing social pain as physically painful: feeling ‘crushed’, ‘wounded’, ‘emotionally scarred’ or like getting ‘a slap in the face’ (p. 206). With echoes of Bentham’s (1789/1907) classification of various pains and their kinds, Lieberman and Eisenberger (2009) espouse a wide view of what pain might include, suggesting that ‘[f]or every state of deprivation associated with a particular need, there is a pain. Lack of food begets hunger, lack of water begets thirst, and lack of shelter begets thermal discomfort. Each of these pains motivates us to seek out the salve that will take the pain away and satisfy the underlying need’ (p. 891). This broad conceptualisation permits the idea that overlap could lie beyond mere unpleasantness (see also Kross et al., 2011), and that various sources of pain might conceptually overlap simply by virtue of being painful.

From an evolutionary perspective, the origin of overlap is founded on humans’ fundamental need to belong (Baumeister & Leary, 1995) and the effectiveness of pain as a threat-signal for directing attention and marshaling resources to cope (Eccleston & Crombez, 1999). Predecessors who were able to detect, respond to or prevent social exclusion were arguably better positioned to avoid the risks to survival that rejection would bring. Hurt feelings would therefore provide the signal and the impetus to adaptively and appropriately respond to social injury (K. D. Williams, 2007a), just as physical pain flags risks to physical integrity and drives a response (A. D. Craig, 2003b). This provides an evolutionary explanation for why emotional suffering might be adaptive following exclusion, and for why physical and social pain would present as similarly ‘hurtful’.

Eisenberger (2015) has reiterated that the affective distress arising from both types of pain is what binds them together. Specifically, the critical *common experiential element* is said to lie in the affective component of pain (p. 621). At a basic level, looking for overlap in the affective component is consistent with the absence of a sensory peripheral mechanism for social pain (Papini, Fuchs, & Torres, 2015). Isolating the affective and sensory components of pain in order to understand what aspects overlap is also intuitively appealing (Eisenberger, 2015), and may alleviate the issue of perceptual overlap being incongruent with lived experience – ostensibly, one “knows” that a broken toe is different to a breakup because of sensory differences, so it is the affective component of distress that links the two experiences together.

But what then is the specific substrate or mechanism of pain overlap? With this question the literature reaches a critical juncture. Over more than a decade, Eisenberger and colleagues provided theoretical and experimental support for a common neural substrate for social and physical pain, comprising dorsal anterior cingulate cortex, insula, and other key regions (Eisenberger, 2015; Eisenberger, 2012a; Eisenberger & Lieberman, 2004; Eisenberger et al., 2003; see also Kross, Breman, Mischel, Smith, & Wager, 2011). This body of evidence gave weight to the promise of a mechanistic explanation for overlap (Panksepp, 2003), where social pain is mapped onto physical

pain signaling systems and operates through putatively shared neurochemistry and brain activation patterns (Eisenberger, 2012a, 2012c). In its furthest extension, neurological overlap was posited as a neat explanation for crossover modulation of the pain experience, because '…to the extent that physical and social pain rely on similar neural systems, factors, such as social support, that downregulate one type of pain (social pain) should also downregulate other types of pain (physical)' (Eisenberger, 2008, p. 189).

However, after a decade of consistent advocacy for neurological pain overlap, a shift in the literature appears to be underway. A comprehensive meta-analysis by Cacioppo et al. (2013) reexamined existing social pain and physical pain fMRI data, seeking to address concerns about small sample sizes, and failed to find support for the assertion that the experience of social pain (ostracism) mirrors the proposed physical pain signature. Next, Iannetti, Salomons, Moayedi, Mouraux, and Davis (2013) detailed concerns with the logical foundations of fMRI-based overlap, suggesting that the prevailing evidence of co-activation lacked the specificity to distinguish pain from other categories of stimuli (see also Poldrack, 2006), and therefore could not of itself provide evidence of shared neural regions specific to pain. They suggested that the observed patterns of activation might not be exclusive to social or physical pain experiences but rather to multiple salient categories of stimuli, for instance, stimuli broadly pertaining to threat (see also Iannetti & Mouraux, 2011; Legrain et al., 2011). Furthermore, Iannetti et al. (2013) raised the possibility that perceptual differences in the experiences of social and physical pain could be better characterised with novel neuroimaging analysis techniques (e.g., Wager et al., 2013).

Now recent findings offer empirical evidence of separate neural representations of physical pain and social pain. Woo et al. (2014) used multivariate fMRI analysis techniques and drew on pre-existing datasets from Kross et al. (2011) and Wager et al. (2013). They specifically tested for overlap in the activation of neuronal subpopulations within posited regions of broader anatomical overlap, and found distinct neural patterns of activation at this level of analysis. Woo and colleagues assert that 'claims about shared representation in the previous studies have been based on findings of overlapping univariate fMRI activity between pain and rejection, which is not anatomically specific enough to bear on the question of whether the underlying neural representations are similar' (p. 6). These findings give cause for reflection on the proposed nature of pain overlap, and further analysis and debate continues (Eisenberger, 2015; Rotge et al., 2015).

However, this also provides a window of opportunity to shift the parameters of the discussion. In taking stock, some perspectives on the shared neural substrates of social and physical pain have specifically raised the question of whether the search for pain overlap has been overly narrative-driven (Cacioppo et al., 2013; Iannetti et al., 2013). Thinking about pain overlap in terms of neural substrates has produced novel conceptions of 'hurt feelings', but recent developments

show there is still more to be learned in understanding how social and physical pain interrelate and the substance of their proposed interconnectedness. Looking back, the original integrative perspective envisaged a range of domains for overlap, exploring 'convergence between the two types of pain in thought, emotion and behaviour' (MacDonald & Leary, 2005, p. 202). This foundational work advocated for similarity, but still advised further research into 'discrepancies' in the integrative narrative along multiple domains (MacDonald & Leary, 2005, p. 217). However, nearly ten years on, researchers have tended to focus on shared qualities of the pain *experience*, and have addressed questions relating to similarities and differences along other domains much less vigorously (*cf*, for example, Chen, Williams, Fitness, & Newton, 2008; Riva, Wesselmann, Wirth, Carter-Sowell, & Williams, 2014; Riva, Williams, & Gallucci, 2014; Riva, Wirth, & Williams, 2011; discussed further below).

At this juncture we see a compelling rationale to reframe the approach with a contextualised notion of pain in mind. The arc of the literature shows a notion of pain that is being increasingly constrained by the focus on the *feeling* of pain. Moving beyond this focus on feeling, we seek to return to an understanding of pain that encompasses its psychological context; such as appraisal, attributions, affect, beliefs, attitudes, and behaviours, that contribute to meaning making and which form the basis of much psychological theorizing (Aldrich & Eccleston, 2000; Gray & Wegner, 2008; Lazarus & Folkman, 1984; Moseley & Arntz, 2007; C. L. Park & Folkman, 1997; Tomaka, Blascovich, Kibler, & Ernst, 1997). This will better reflect the current biopsychosocial understanding of pain itself.

In the next section we delineate some definitional points, then proceed to three key foundations for contextualisation: pain antecedents; cognitions and affect; and behaviour. These illustrate that when pain is contextualised, a range of similarities and differences can come to the fore, and this yields a more comprehensive analysis of social and physical pain.

Antecedents: Looking at the Source of Pain

In this chapter we use the terms 'physical' and 'social' pain to differentiate pain on the basis of its source. This provides a workable but imperfect way to describe and delineate these two pains, because labeling pain based on its origin is controversial. The IASP definition of pain specifically seeks to avoid yoking pain to a stimulus: pain is always a psychological state, and not necessarily proportionate to nociception (IASP, 1994/2014). Modern pain theory eschews the idea that pain needs a physical cause in order to be 'real'. Accordingly it is considered loaded discourse to label a pain that is felt in the body as *physical*: tautological at best ("all pain is physically experienced") and a misnomer at worst ("only physical pain is real pain"). A phenomenological approach to pain aims to address these tensions and proposes that all pain subjectively felt is *pain*. This unties pain from any particular stimulus or objective cause and situates pain as a product of the brain (Melzack

& Katz, 2013). Importantly, this also clears the path for different pain types to be brought together conceptually on the basis of overlap in subjective experience – because subjectively, these pains could feel the same.

Yet psychologically, we argue, *pain source* still matters. It is a necessary and frequently touted reminder that a heart attack is very different to the experience of a lover's rejection; a broken heart is not actually broken. There are important differences between social and physical pain. Iannetti et al. (2013) suggest that these differences are perceptual and that the two pains are readily distinguished by reference to how they feel to the person undergoing the experience – social pain presents as emotional distress, while physical pain is experienced as a sensory and emotional phenomenon. However, this proposes that social pain and physical pain are distinguishable because they *feel* different, and the two experiences continue to be delineated simply by virtue of the feeling alone. This makes an empirical resolution elusive, because subjectively, if these pains actually do *feel* the same, then they *are* the same.

We propose that even if social pain and physical pain feel the same, these two pains are psychologically and conceptually inseparable from their antecedents. MacDonald and Leary (2005) describe social pain as '…a specific emotional reaction to the perception that one is being excluded from desired relationships or being devalued by desired relationship partners or groups.' (p. 202). Social pain is of itself the appreciation of a shift in one's relational value in the eyes of others, and the *social* dimension of social pain must be retained to make sense of it. It is precisely the realization that one has been rejected by another which creates hurt feelings; by definition, in order to feel social pain, one must have a perception of the social context in which the relational transaction triggering distress has taken place.

The antecedents of social pain differentiate it from physical pain in essential ways, because what has triggered pain categorically alters the psychological nature of pain. Even if social and physical pain subjectively feel the same, or simply share a common experiential element, social pain necessarily prompts a different recalculation of our social world and our position within it – and this distinction from physical pain is psychologically important. This is because information about the source of pain is part of the situational milieu that informs how we then go on to experience, appraise, and respond to pain (Benedetti, Thoen, Blanchard, Vighetti, & Arduino, 2013; Gray & Wegner, 2008; Moseley & Arntz, 2007). Taking up a contextualised model of pain provides a clearer view of these pain precursors, by situating the pain experience and taking account of contributory factors. We suggest this analysis provides a better starting point in providing a comprehensive psychology of both types of pain.

Pain, Cognition and Affect: Pain is Not a Passive Percept

We also propose that the focus on experiential qualities or 'qualia' overlap places additional limitations beyond the question of where pain has come from. Dennett (1988) described qualia in terms of 'corralling the quicksilver', saying that ''[q]ualia' is an unfamiliar term for something that could not be more familiar to each of us: the *ways things seem to us.*' (p. 42)[1]. Much of the pain overlap literature has focused on these qualities of the pain-state, and how this experience may be common across pain types.

However, focusing on the pain-state means there is a risk of overlooking cognitive and affective processes surrounding pain. Looking back, conventional perspectives on pain captured cognitive and emotional dimensions of pain as mere reactions to pain, rather than components of it (Melzack, 1999; Melzack & Katz, 2013). More recent notions treat pain affect as more than just a reaction to pain – it is now considered a critical constituent of pain. Bringing psychological dimensions like pain affect into the circle as constituents of pain has elevated their status as functionally significant components of painfulness (see for example, Fernandez & Turk, 1992; Price, 2000). However, a thorough analysis must also look to account for psychological processes beyond the experience, and not simply those processes viewed as constituting it in a strict sense.

This is because fixing upon similarities in the experience of painfulness runs the risk of making pain a passive percept, inadvertently diminishing pain to a feeling passively felt. Such an approach obscures an important psychological overlay that adds richness to how pain can be understood. These are the thoughts and emotions underpinning how we anticipate, emotionally react to, consciously reflect upon and conceptualise pain: the role of affect, pain appraisal, attribution, and beliefs and attitudes that contribute to meaning making (for example, Benedetti et al., 2013; Gray & Wegner, 2008; Lazarus & Folkman, 1984; Moseley & Arntz, 2007; Tomaka et al., 1997). Contextualising pain simply means bringing these externalities back into the frame – keeping critical psychological factors within scope.

Empirical work that responds to this need is emerging. Research has examined memory for, and temporal projections of, social and physical pain. This has shown that past social pain is more readily and intensely relived than past physical pain (Chen et al., 2008; Meyer, Williams, & Eisenberger, 2015), and imagined future social pain is more intensely experienced than future physical pain (Chen & Williams, 2012). Other efforts have reached further beyond the pain experience to examine the psychological consequences of pain. For instance, Riva et al. (2011) examined the effects of social and physical pain on self-reported needs satisfaction (self-esteem, belonging, control and meaningful existence), desire to aggress, negative affect and feelings of

[1] Notably, Dennett went on to argue for the non-existence of qualia – a debate with which we do not engage here.

ostracism (Study 2). They report that social and physical pain *both* decrease overall needs satisfaction; and both increase desire to aggress, negative affect, and feelings of being ignored and excluded (compared to control treatments). However, direct comparison showed that social and physical pain triggered a different profile of responses along these measures: social pain was significantly more damaging than physical pain on overall needs satisfaction, sense of belonging, meaningful existence, and feelings of ostracism. Social and physical pain, it would seem, can each produce a different profile of psychological consequences.

Critically, these differences are observed when considering thoughts and emotions surrounding pain rather than focusing on similarities in the pain experience itself. This provides early confirmation that opportunities exist to expand our approach to social and physical pain in psychological terms. As an example of this potential, one might consider the psychological contribution of meaning-making about pain, and how accounting for this cognitive process could give greater theoretical depth to the analysis of pain overlap. Making meaning about pain is a meta-product of pain cognition that can reframe future pain and contribute to 'a shared social and linguistic culture of pain' (Aldrich & Eccleston, 2000, p. 1632). Meaning-making may be seen as an avenue for cognitive agency, of immense value where control and dominion over one's own pain-state may seem distant. In looking at everyday pain, Aldrich and Eccleston (2000) offer a concept of physical pain as a culturally embedded phenomenon, and put forward eight clusters of meaning for pain derived from a qualitative Q-factor exploration of everyday pain. Physical pain is shown to represent multiple constellations of meaning, from 'pain-as-self-growth' to 'pain-as-abuse'. Critically, their analysis shows that everyday physical pain can present as a singular phenomenon but is the basis for diverse clusters of meaning. This highlights the possibility for a spectrum of meanings not only within, but between, pain types: the meanings ascribed to social pain may be worlds apart from meaning-making about physical pain, or may share important common ground.

By way of a further example, an extensive literature exists on the role of cognitive and affective factors in modulating physical pain, which hints at the possibility for deeper comparative work. For instance, fear and expectation, attentional set and mood all contribute to physical pain magnitude: anticipating low painfulness can reduce reported pain (Koyama, McHaffie, Laurienti, & Coghill, 2005), as can prior attentional set toward non-pain tasks (Van Ryckeghem, Crombez, Eccleston, Legrain, & Van Damme, 2013) or positive mood (Villemure & Bushnell, 2009; Villemure, Slotnick, & Bushnell, 2003). Experimentally-induced depressed mood heightens the unpleasantness of physical pain (Berna et al., 2010). Placebo and nocebo effects for physical pain are well documented (see Tracey, 2010, for review). Fear of pain and catastrophization amplify painfulness (Campbell & Edwards, 2009; Sullivan et al., 2001). Significant work has been done to

explore the role of fear (see Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012 for review) and catastrophizing (Sullivan, Bishop, & Pivik, 1995) in the transition toward chronic pain.

Notably, a comparable literature along these domains for social pain has not coalesced; and how social and physical pain might compare across each of these elements is yet to be explored. However, there are instances of empirical and theoretical work (Riva, Wesselmann, et al., 2014; Riva, Williams, et al., 2014). For example, comparing fear of social and physical pain, Riva, Williams, et al. (2014) examined crossover in fear of physical and social 'threat' with the development of the Fear of Social Threat Scale (based on the Fear of Pain Questionnaire; McNeil & Rainwater, 1998). They report the existence of two discrete fear constructs that are positively correlated, suggesting support for qualified convergence of fear type (Study 1). However, each fear type uniquely predicted perceptions of the corresponding pain: in Study 2, fear of social threat uniquely predicted ratings of social distress from ostracism in Cyberball, while in Study 3, fear of physical pain uniquely predicted pain ratings of subsequent physical pain. This shows that there are commonalities (i.e. crossover in fear of both pain types), but by looking beneath this veneer, differences emerge, and this adds depth to our understanding of how pain and fear interrelate. Moreover, this early work demonstrates how we can begin to consider similarities and differences across new domains: by applying a contextualised approach to pain, the horizons for inquiry are considerably broadened – and this promises a richer understanding of both pains as a result.

In sum, pockets of empirical and theoretical work are emerging but there remains more to be done. Specifically, there are promising literatures on pain meaning-making and other cognitive-affective modulators of physical pain, but the extent and nature of overlap between social and physical pain along these and other lines remains largely untested. Above, we have provided illustrative findings on the cognitive and affective dimensions of pain *within* pain types, but these examples hint at the range of comparative opportunities where similarities and differences between pain types can be examined. Applied more broadly, a contextualised approach to pain can reinvigorate inquiry into social and physical pain that specifically extends over and above their common experiential elements. We advocate further examination of social pain and physical pain along cognitive and affective dimensions, as part of the potential contribution of the contextualised approach to pain we propose.

Responding to Pain: Others and Self

So far we have canvassed the issues associated with overlap largely within the confines of the internal world – qualia, thoughts, emotions. We turn now to look at behavioural responses to pain. Key theories about the evolutionary origin and functions of pain rely on pain's ability to motivate a response – such as instigating withdrawal or avoidance to mitigate bodily damage or escape death; or producing facial expressions of pain as a signal to others (A. C. Williams, 2002).

We anticipate that contextualised pain promises better explanatory value for these and other post-pain behaviours. As discussed earlier, contextualising pain means considering where pain has come from, why pain has occurred, what it means to be experiencing it, whether it is considered a threat or a positive challenge, whether it has occurred before and whether it is likely to happen again – each of which may underpin how a person behaviourally responds to pain. If pain is not placed within its psychological context, factors that might explain the processes underlying behaviour will reside outside the frame.

Next, we highlight three examples that illustrate the theoretical limits of the overlap metaphor and the prevailing focus on qualia overlap relating to behavioural responses to pain. Our first two examples draw on evolutionary approaches to pain, and Craig's (2003b) model of pain as a homeostatic emotion. The third example draws from the social pain literature to examine socio-behavioural (interpersonal) responses.

Pain motivates adaptive responses. First, linking pains on the basis of shared qualia may be problematic from an evolutionary perspective. The putative function of pain is to signal imminent or actual harm, promote avoidance of painful stimuli and threats, and aid survival (Bateson, 1991; Eccleston & Crombez, 1999). Social pain was thought to have co-opted the physical pain signaling system, on the basis of pain's special capacity to snare attention, and the presence of selection pressures that would favor those adept at detecting risks to social inclusion (K. D. Williams, 2007a). The utility of a 'piggy-backed' signal (Nelson & Panksepp, 1998) therefore relies on individuals having sufficient ability to sensitively distinguish pain signals in order to respond appropriately and adaptively to the corresponding threat. Mere overlap in the qualities of painfulness oversimplifies this model and undercuts the utility of the threat calculus. To understand how people mount an appropriate response to threat, we need to take into account more than the qualities of the experience alone. The threat calculus requires concrete knowledge of where pain has come from, how it relates to prior experience, what its meaning is, and other factors that may come into play in driving an adaptive response to pain.

Similarly, tethering social and physical pain based on how pain feels fits awkwardly with the concept of pain as a homeostatic emotion (A. D. Craig, 2003b). The premise of the homeostatic pain model is that pain is both a sensory and emotional experience that drives appropriate responses to maintain complex parameters required for the integrity of the body. Pain is viewed as more than just a somatosensory representation, or a sub-type of exteroception, because pain is different to other sensory modalities that provide information about the external world. Rather, pain carries a dual role, much like hunger or thirst. This makes pain both an interoceptive state (feeling in the body) and a functional driver of survival-regulation through motivation and action (A. D. Craig, 2003b). It also indicates that pain that *feels* the same will trigger the same response, if the subjective

interoceptive experience of pain *constitutes* the motivational drive to respond. Accordingly, within this model, homogeneity of the pain experience undermines the usefulness of pain as a basic threat-signal. This is because the utility of homeostatic pain is to prompt a cascade of tailored and specific responses that correspond to the nature of the imbalance to restore homeostasis. The output of this complex calculus is unlikely to be well-represented theoretically if pain itself is inadequately contextualised. The broken heart is not broken, even though it hurts – and the difference matters in driving action and response.

Thus, we suggest that the prevailing focus on qualia overlap sits uncomfortably with evolutionary and homeostatic pain theories that are based on appropriate pain responding being a survival advantage. These theories invite a more nuanced picture of pain, beyond the experience itself, in order to realise their full explanatory potential. In line with this, a contextualised approach to pain opens the door to a more expansive inquiry into social and physical pain, through which these theoretical disparities might be examined and reconciled.

Socio-behavioural responses and relational value. A further illustration of theoretical tension can be found in looking at socio-behavioural responses to pain, where we suggest the predictive value of a constrained notion of pain is trumped by a contextualised approach to pain. Marked differences in socio-behavioural responses to social pain show that even within social pain there is *variability* in how we react. This gives cause for caution in the context of pain overlap. Specifically, social pain is known to differentially trigger approach, avoidance and aggressive socio-behavioural responses. Forms of social pain such as social exclusion and rejection have been found to lead to emotional insensitivity and reduced empathy for others' mishaps (DeWall & Baumeister, 2006); decreased donating, helping and cooperating (Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007); and increased aggression toward innocent others (Twenge, Baumeister, Tice, & Stucke, 2001). Conversely, interpersonal rejection has also been linked to a greater inclination to make new friends and work with others; to make more favorable impressions of potential new afilliative targets, and to offer higher rewards to new interaction targets (Maner, DeWall, Baumeister, & Schaller, 2007). Evidently there is substantial diversity in the socio-behavioural consequences of social pain. This varied picture *within* social pain flags the need to carefully contextualise pain in order to explain why certain responses occur and when. Even within one pain 'type', responses to social pain cannot be determined based on the qualities of the experience alone – more information is required (Leary, 2005).

Specifically, a key theme in social pain response theories is that responses are predicated on negative affect or reduced relational value flowing from social pain. Such theories rest on social pain being an innately negative experience. For instance, Smart Richman and Leary's (2009) multi-motive model of interpersonal rejection proposes that following post-event negative affect and

lowered self-esteem, different construals about the event (for example, about the prospects of relational repair, the social cost of the damage, and the duration of the loss) predict the nature of the motivated response. However, the model starts with the idea that social pain leads to an immediate lowering of self-esteem and increase in negative affect. How pain is construed is directly leveraged from these (negative) effects of social pain. In this way, Smart Richman and Leary's (2009) theory highlights an important distinction in the psychology of social and physical pain. It sets the premise that experiencing social pain is negative in how it affects us as social beings, with the presupposition that the experience will give rise to negative affect and lower self-esteem.

This directly brings attention to a major contrastive feature: social pain represents a tear in our social fabric, where social value, actual or perceived, has diminished, and the fundamental need to belong is undermined. In contrast, physical pain need not always give rise to immediate negative affect (Franklin, Lee, Hanna, & Prinstein, 2013) or lowered self-esteem, and instead may serve to display and promote personal virtues that offer social advantages (Bastian, Jetten, Hornsey, et al., 2014). Physical pain can give the opportunity for martyrdom, to transcend bodily limitations, and display self-mastery, patience, endurance and efficacy (Bastian, Jetten, Hornsey, et al., 2014). Undergoing physical pain can reduce feelings of guilt and restore moral balance (Bastian, Jetten, & Fasoli, 2011; Bastian, Jetten, & Stewart, 2013), and lower one's guilt and blameworthiness in the eyes of others (Gray & Wegner, 2010, 2011). While perceived or actual social devaluation or loss may accompany physical pain, there are many examples where it does not.

These distinctions show the potential for a different approach in predicting and explaining responses to pain – one that accounts for where pain has come from and what it means to the person experiencing it, which cannot readily be imputed from the experience alone. For instance, physical pain might be engaged in agentically, bringing to bear a different frame for painfulness: physical pain is indeed generally aversive, but can also bring pleasure, for instance during pain (through sexual arousal, or sense of satisfaction from endurance), or after pain (through relief, contrast, positive appraisal, or sense of achievement; Franklin, Lee, Hanna, & Prinstein, 2013; Leknes, Lee, Berna, Andersson, & Tracey, 2011; see Leknes & Bastian, 2014, for review). There are interesting counter-examples in social pain terms, such as seeking out social pain through erotic humiliation, or self-isolation – yet whether these experiences can be considered analogous to agentic physical pain and in what respects remains an empirical question, as well as how social pain might itself be experienced differently when agentically sought out. Ultimately, this reiterates the need to contextualise pain in order to adequately develop theory around what the response to that pain might be. It also underscores the possibilities for novel hypotheses and the generation of empirical evidence to specifically test these areas of interest.

In sum, while social pain undermines relational value and self-esteem, there is a growing empirical basis to support the idea that physical pain may, perhaps counter-intuitively, elevate the self in ways that are relevant for socio-behavioural outcomes. More broadly, an emerging literature on the benefits of pain highlights new ways of thinking about pain outcomes (see Bastian, Jetten, Hornsey, et al., 2014 for review). This brings to light how social pain and physical pain can give rise to different socio-behavioural responses, and invites theoretical reflection and empirical consolidation with reference to pain overlap. Again, new lines of inquiry are opened by applying a contextualised approach to pain, and this promises a better understanding of both pains.

Reflecting on Pain Overlap

Acknowledging social pain as a construct that might share experiential qualities with physical pain expands our understanding of what pain is, and drives home some pressing definitional points. Over two decades ago, Morris (1991) shone a light on what he called the Myth of Two Pains, saying that '[w]e live in an era when many people believe – as a basic, unexamined foundation of thought – that pain comes divided into separate types: physical and mental. …Between these two different events we seem to imagine a gulf so wide that it might as well be filled by a sea that is impossible to navigate.' (p. 9). Research into pain overlap demonstrates that we have left the shore. By understanding pain as subjective, we validate pain experiences that lack a clear physical aetiology. There is now greater acceptance of psychological explanations for physical pain phenomena, and of pain being more than nociception. However, a broader notion of pain brings new controversies about how to deal with what is now 'mind pain' (hurt feelings) and 'body pain' (feeling hurt). There is still scope to wonder whether social pain can correctly be denied the status of pain if it is experienced as hurtful, as *painful* (Biro, 2010).

Poetic hypotheses like pain overlap hold a special place within our scientific tradition. There is now a substantial line of research and commentary seeking to unpack how social pain might mirror physical pain (Cacioppo et al., 2013; DeWall et al., 2010; Eisenberger, 2012a, 2012c; Eisenberger & Lieberman, 2004; Eisenberger et al., 2003; Iannetti et al., 2013; Lieberman & Eisenberger, 2009; MacDonald & Leary, 2005). With recent studies showing mixed support for neural overlap (Cacioppo et al., 2013; Rotge et al., 2015; Woo et al., 2014), it is timely to reflect on the posited domains of commonality between social and physical pain. These developments invite our consideration of the deeper implications of the search for similarity. Perhaps the subtext of the comparison seems to be that when associated with physical pain, social pain is bolstered in its existential veracity; the 'realness' of social pain is enhanced by association with physical pain, so that it might similarly deserve attention and remedy as physical pain does. Indeed, Eisenberger (2015) articulates these hopes: 'Social pain is similarly conceptualised as being outside the purview of medical attention because it seems more psychological or emotional than physical. Focusing on

treating the affective component of pain might serve to level this playing field, putting the need to treat various types of physical and social pains at the same level of importance and perhaps providing new avenues for treatment.' (p. 623). However, in developing a comprehensive psychology of pain, our own purview need not be confined to conventional medical conceptualisations or neural indices alone, in order to understand pain and bring attention to suffering. A scientific approach to pain reasonably leads to a desire to confine pain to what is observable, measurable, and even what is treatable. But both pains remain elusive as yet to perfect scientific extraction, despite technological advances. Pain remains complex and private, resisting objective scrutiny and measurement. Rather than suggesting scientific efforts are futile, these difficulties are a reminder that a comprehensive understanding of pain is where our best and most innovative efforts can be directed.

The Next Wave: Future Directions in Pain Overlap

A critical test of the contextualised approach is whether its application can strike new paths for pain overlap research. We have proposed a framework for the contextualisation of pain that encourages consideration of the antecedents, cognitions and affect, and sociobehavioural consequences of pain. This is with the aim of setting out broad domains for analysis, beyond neural overlap, when examining how social and physical pain are interrelated. The next steps are to put this into action. Throughout this chapter we have highlighted illustrative examples and opportunities for the application of a contextualised model of pain, with the aim of expanding how pain overlap is approached. By utilizing what is already known about each pain in the psychological areas we have identified, researchers can critically examine whether social and physical pain give rise to the same patterns and effects. As more is learned about the science of each pain, we can continue to query whether each phenomenon also holds for its counterpart. We expect this cycle of reconceptualisation will be an enduring and generative process, and one that psychological perspectives must inform. Below we offer examples of how this process might progress. In setting these out, we do not propose to be exhaustive – again, the intention is to illustrate and guide rather than prescribe.

The elaboration of antecedents and their effects. Where pain has come from is fundamental in developing a comprehensive understanding of painfulness, and we earlier set out a rationale for why it is important to account for antecedents of pain. There is a need for further research to take up this mantle. Our analysis has focused on antecedents in terms of the *source* of pain or its putative cause, as this has served to illustrate an essential component of how social and physical pain differ. Naturally, the antecedents of pain comprise more than just the classification of its source. In further elaborating the antecedents of pain, this opens the door to examining a range of temporal antecedents, the effects of which may reverberate for the duration of pain, and after pain.

In application to overlap, analyzing pain antecedents can more effectively unravel the factors that exacerbate or soothe and specifically reveal whether or not these factors operate consistently for both pain types. For instance, the knowledge that physical pain might bring a physical benefit helps the recipient to better tolerate it (Benedetti et al., 2013). Would the notion that social pain is 'good for us' serve a similar purpose? Intentional physical pain hurts us more than unintended pain (Gray & Wegner, 2008); yet what if harm was not the intended aim of the pain? Prior beliefs *about* causes of pain, conceptions about whether pain is biological or mysterious, motivated, personal, intended, deserved, beneficial, or worthwhile – these are all potential psychological contributors in the lead-up to pain, for which overlap between social and physical pain should be critically tested.

Furthermore, pain events do not occur in an experiential vacuum. Prior instances of pain give a salient and highly relevant context to new pain. For non-chronic physical pain, recent intense pain appears to create a new perceptual benchmark where subsequent moderate pain can be experienced as relatively pleasurable (Leknes et al., 2013; Leknes, Brooks, Wiech, & Tracey, 2008). This relative 'hedonic flip' from painful to pleasant highlights how pain context shapes experience; but it remains to be tested whether social pain is also experienced in this way. After rejection or ostracism by desired social targets, the proposition that a subsequent yet smaller quantum of rejection might take on a pleasurable edge seems remote. Notably, emotional and physical numbing following social pain has been documented (DeWall & Baumeister, 2006; Maner et al., 2007; Twenge, Catanese, & Baumeister, 2003). However, it is plausible that in the context of very recent and intense social pain, a secondary social injury of the same nature would be rendered even more hurtful – a small twist of the knife made all the more painful by deep cuts of rejection preceding it.

The lived experience of chronic pain also represents a complex antecedent for subsequent painfulness. Riva, Wesselmann, et al. (2014) have proposed an integrated chronic model of pain that suggests there is overlap in the development and maintenance of chronic social and physical pain – such as common antecedent factors (such as early and repeated pain experiences), maintenance factors (hypervigilance, fear) and outcomes (learned helplessness, worthlessness). Systematic and prospective substantiation of this model has yet to be carried out; while the theoretical fabric of the model emphasises commonalities, by laying out falsifiable hypotheses we see that it sets a path for identifying non-common factors also. We would advocate continued inquiry into the role of prior pain as a psychological antecedent of social and physical pain, both acute and chronic.

These examples are non-exhaustive but illustrative of how contextualised pain can be used to develop novel hypotheses about antecedent factors and their effects, along which social and physical pain might (or might not) overlap. Being more expansive about pain antecedents also

means looking outside their specific analgesic or antagonistic effects. With the clear potential for pain antecedents to feed directly into the cognitive and emotional aspects of pain itself, we can also see potential for future research specifically into those cognitive and emotional domains.

The further examination of pain cognitions and affect. As we have indicated, novel research opportunities lie in critically examining overlap in thoughts and emotions relating to pain. There are extensive opportunities to develop the literature further here; if we have been successful in expounding the need for a more contextualised approach to pain overlap, then what follows is likely to be a brief representation of the possibilities. We have noted the rich literature on cognitive and emotional features and modulators of physical pain (mood, attention, catastrophization), and highlighted the opportunity for cross-pollination by testing and comparing these phenomena in relation to social pain. We have also described empirical and theoretical research into fear of social and physical pain. Beyond these developments, there is scope to examine how personal, relational, social and cultural meanings of pain can transform painfulness; and in turn how this might be the same or different for social and physical pain. Articulating and empirically examining the implications of these meanings in a systematic way is an important yet presently neglected area of pain overlap research. Pain as punishment, pain as damage, as necessary or character-building, as triumph, pleasure, or growth: fertile ground for future research lies in the meanings of pain and the psychological implications and functions of those meanings. For instance, if physical pain can reduce feelings of guilt and restore moral balance (Bastian et al., 2011), could social pain deliver the same psychological dividend? More concretely, we would expect a link between how pain is cognitively appraised and represented, what pain means, and how it is responded to. Next we discuss future research directions for pain overlap in terms of behavioural consequences.

Investigation of pain responses. We have outlined the potential for sociobehavioural responses to pain to be diverse. Responses to pain can minimise damage, impact ability to obtain support, and underpin the evolutionary basis of pain's effectiveness as a signal. These primeval imperatives are part of what binds pain into the human condition, but are only part of the picture. Much theorizing on pain relies on the basic imperative to avoid pain: avoiding damage, the risk of death, and aversiveness. Yet in many psychosocial contexts, "facing up to pain" carries positive connotations: a sportsperson battling though injuries to complete the game; a mother eschewing analgesics during the birth of her child; a martyr enduring suffering as spiritual devotion. In each of these scenarios, the imputation of agency and the choice to avoid or endure tells much about the psychosocial value of the act, and indicates the potential for collective understandings over and above acknowledgement of or empathy for the pain itself. Determining whether we reach out to others, or deny opportunities for connection, requires a contextualised approach to pain, in order to explain why certain responses occur and when.

For instance, it is unclear whether subjecting the self to social pain would connote positive attributes in the same way as the "facing pain" examples given above. If preexisting beliefs about the *legitimacy* of suffering differ between social and physical pain, then it is feasible that how we react to these pains in relation to others could differ. Others' responses to pain provide the social context in which pain is experienced, and perceptions about whether others will understand what one is going through could readily be expected to impact on whether support is sought or not. Reaching out to others may heighten perceptions of vulnerability, yet there are well-documented benefits where social support is accessed, or even merely salient, during and after pain (J. L. Brown et al., 2003; Jones & Jetten, 2011; Master et al., 2009). Along similar lines, exploring differences in how social and physical pain are displayed or communicated also provides scope to examine the value of pain displays in informing how others perceive and respond to people in pain. This could better connect literatures on sociobehavioural responses to pain (for example, Bastian, Jetten, & Ferris, 2014; Crockett, Kurth-Nelson, Siegel, Dayan, & Dolan, 2014; Hadjistavropoulos et al., 2011; Maner et al., 2007; J. Park & Baumeister, 2015; Sommer & Bernieri, 2015) with literatures on others' empathy for pain (for example, Bernhardt & Singer, 2012; Decety, Echols, & Correll, 2010; Nordgren, Banas, & MacDonald, 2011; Ruben & Hall, 2013) – looking critically at similarities and differences for social and physical pain. Again, while we have simply extracted some specific examples and themes here, each serves to indicate the potential for new research trajectories to develop, and the value of the contextualised approach in moving closer to an understanding of how physical and social pain interrelate.

Conclusions: Reconnecting to a Psychology of Pain

Present contributions to understanding pain overlap have largely concentrated on pain's experiential qualities and neurological manifestations. But important theoretical and functional differences exist between social pain – as a pain that necessarily generates fundamental recalculations of our social world and ourselves in it – and physical pain, as a pain that comprises sensory and emotional aversiveness that may or may not be socially nested. These fundamental differences have faded from prominence in theorizing about physical and social pain overlap. While most research attention has focused on commonalities, we advocate a contextualised notion of pain that can support greater attention to unique and even non-overlapping aspects of social and physical pain.

With this review, we have highlighted some consequences of focusing on pain qualia overlap. Beyond the literature on social and physical pain overlap, much progress has been made in transitioning away from strictly medicalised perspectives and toward a broader biopsychosocial model. Paradoxically, it seems an overemphasis on pain qualia and the pain experience may have stemmed from modern conceptualisations acknowledging pain as subjective, and as more than

nociceptive, stimulus-driven or impersonal. We suggest psychological approaches to pain overlap *can* be adjusted to align with the broader movement toward a biopsychosocial model of pain.

This simply means a shift in how pain is approached – a shift to contextualise pain in terms of its antecedents, and the cognitions and emotions surrounding pain, with a view to better conceptualising how people make meaning from and respond to pain. Accounting for where pain has come from reveals that physical pain and social pain are fundamentally different beyond the subjective state. Considering how people appraise, make meaning, or anticipate pain moves pain away from a passive percept, and generates a richer set of bases on which to compare and contrast social and physical pain. In explaining how people respond to pain, we expect contextualised pain to offer more predictive value: from adaptive reactions to a survival threat, to an agentically sought experience of pain-as-pleasure. A broader analysis provides the way forward in reconnecting to a psychology of pain.

We have not set out precisely where overlap lies or its boundary conditions. Instead, we have proposed a contextualised approach to pain to reinvigorate examination of similarities and differences across novel domains. To set matters in perspective, while debate continues on the substance of neurological overlap, evidence of functional pain-type crossover remains (e.g., Eisenberger et al., 2006; Way et al., 2009). Other features traced out by MacDonald and Leary (2005), such as a common language for social pain in physical terms across cultures, and evidence of physical pain analgesia following social pain (DeWall & Baumeister, 2006) hold empirical value. These foundations do support continued examination of pain overlap, but we have proposed some critical modifications and an expanded purview in terms of how this exercise should go forward. Iannetti et al. (2013) describe the pain overlap story as a ‘glamorous marriage of metaphor and modern science’. Indeed, there is considerable intellectual glamour where literary anecdote and hard science meet. However, beneath the surface, the benefits of the overlap metaphor must be balanced against the potential for information loss. We risk reducing the concept of *pain itself* to its core experiential component if overlap in the pain experience is overemphasised – we risk losing a psychology of pain. Decontextualising pain obstructs the greater intellectual contribution that can be made by situating pain of both types within the psychological world. Already, pain is ‘all in the mind’: we simply need to contextualise it.

Chapter 3

Pain is a fundamental human experience that triggers a range of social and psychological responses. This chapter presents behavioural and fMRI data to examine the effect of multiple group memberships salience on reported and neural indices of pain. Findings were that participants expressed higher levels of pain when more social group memberships were salient. This is consistent with the notion that pain itself motivates people to communicate their pain, and more so when multiple psychological resources are salient. In addition, fMRI results revealed an interesting twist: when participants increased their pain reporting as group memberships increased (from one group to four), there was a corresponding relative reduction in dorsal anterior cingulate cortex and anterior insula activation. These results provide evidence for an adaptive response to pain: the more people make use of the social resources at their disposal when experiencing pain, the less pain areas are activated.

Chapter 3 is the published article:

Ferris, L. J., et al. (2016). Increased Pain Communication following Multiple Group Memberships Salience Leads to a Relative Reduction in Pain-Related Brain Activity. *PLoS One 11*(9): e0163117.

Increased pain communication following multiple group memberships salience leads to a relative reduction in pain-related brain activity

Pain is a subjective sensory and emotional experience that contributes substantially to global disease burden (Fernandez & Turk, 1992; International Association for the Study of Pain, 1994/2016; Price, 2000). Pain is private, subjective, and intrapersonal; but it is also experienced and expressed within a social context (K. D. Craig, 2009; Hadjistavropoulos et al., 2011; Mogil, 2015; Morris, 1991; Scarry, 1985). Communicating pain to others is a key step in securing aid and social support from others (A. C. Williams, 2002). This makes it important to understand how social resources contribute to how pain is experienced and reported.

Social group memberships are one way to examine how social resources affect pain and its communication. Group memberships – and the social identity that we derive from them – can be considered valuable resources that people may draw upon in responding to pain. By self-categorizing as a member of a group, individuals derive *social* identity that dynamically informs their understanding of self relative to others (Tajfel & Turner, 1979). The term 'group' is defined broadly, such that a person may self-categorise as a member of a social or demographic category (males, Americans), or other groups based on different parameters (scientists, cancer survivors; Jetten, Haslam, & Haslam, 2012). With relevance to pain, there is a growing body of work showing the role of group memberships in buffering and overcoming suffering (Cruwys, South, Greenaway, & Haslam, 2014; Dingle, Cruwys, & Frings, 2015; Drury, 2012; Jetten, Haslam, Haslam, Dingle, & Jones, 2014). It follows that membership in more groups should arm people to better respond to painful challenges, and if group memberships are resources, then more resources should flow from the salience of more group memberships. This notion builds on the idea of 'the social cure', whereby group memberships can deliver socioemotional and health benefits by building social resources (Jetten et al., 2014).

However, it remains to be seen precisely how these resources affect pain communication. Combining neuroimaging with pain reports provides a way to understand pain on behavioural and neural levels (Wager & Atlas, 2013; Wager et al., 2013), and here we examine how these indices are affected by salient social group memberships. Does the salience of one's group memberships *buffer* the pain experience and diminish the need to report pain (lower pain reporting), or alternatively, does it imply a supportive environment or 'safe space' to express and communicate our pain (elevated pain reporting)? We explore these opposing predictions in turn.

Groups Facilitate Communication of Pain

Group memberships are a scaffold for communication because they provide common language, goals, motivations, and 'shared reality' (Greenaway, Wright, Willingham, Reynolds, & Haslam, 2015). Although pain is a subjective, internal experience, pain can be conveyed to others

through facial expression, non-verbal vocalization, pain behaviours, and language. The social milieu in which these processes occur plays a critical role in determining their nature and outcomes (Hadjistavropoulos et al., 2011). Expressing pain to our ingroup is functional: at a basic level, pain communication can aid the sufferer by limiting exposure to the nociceptive source and minimizing damage, as pain expressions and distress vocalizations provide valuable signals to conspecifics on potential risks, dangers, and ameliorative action required (K. D. Craig, 2004; Herman & Panksepp, 1978; A. C. Williams, 2002; Yamada & Decety, 2009). Expressing pain can itself serve psychological functions – simply vocalizing pain improves pain tolerance, such as saying "ow" (Swee & Schirmer, 2015) or even swearing (Stephens, Atkins, & Kingston, 2009; Stephens & Umland, 2011). Signalling pain is also a way to engender empathy and helping behaviours in others, because seeing others in pain elicits empathy and helping, particularly between ingroup members (Tarrant, Dazeley, & Cottom, 2009).

If expressing pain to those around us serves to enhance the provision of support, this strategy is more likely to serve as a functional response to pain when more social resources are available or perceived. On this basis, communicating pain in response to social groups is adaptive because it facilitates access to psychosocial resources, and may even carry its own inherent payoffs. In short, people may be more likely to express their pain the more social resources are salient.

Buffering Pain: What Do Groups Offer?

An alternative line of reasoning shifts the focus to group memberships as a more direct buffer for pain. There is now a wealth of evidence demonstrating the positive impact of belonging to social groups on health and well-being, and the deleterious effects of social isolation (Cacioppo, Capitanio, & Cacioppo, 2014; Holt-Lunstad, Smith, & Layton, 2010). Social support is linked with reduced pain and lower analgesic consumption during childbirth (Cogan & Spinnato, 1988; Hodnett et al., 2015), better recovery from surgery (King, Reis, Porter, & Norsen, 1993; Kulik & Mahler, 1989); and improved pain adjustment in the context of chronic pain (Lopez-Martinez, Esteve-Zarazaga, & Ramirez-Maestre, 2008). Reassurance from ingroup (versus outgroup) members during pain reduces physiological arousal measured by galvanic skin response (Platow et al., 2007).

It follows that if group memberships are an important resource during pain, the more of this resource one has, the better protected one is. Jones and Jetten (2011) provided experimental evidence for the 'more the merrier' effect by varying the number of group memberships (1, 3 or 5) that were made salient to participants. Participants were asked to self-categorise in terms of either one, three or five social groups, and then to write about why each of the relevant groups was important to them. In conditions where more group memberships were salient, participants were able to endure physical pain from the cold pressor task for longer periods. Notably, when five groups were made salient participants were able to keep their hand in freezing water twice as long

as participants for whom only one group membership was made salient. Aside from the tangible support that group membership provides, this suggests that the mere psychological availability and salience of social group membership acts as a resource for building resilience. However, questions remain. As Jetten and Jones' (2011) dependent measure involved resilience in the face of challenge, it is less clear how participants' experience of pain itself was affected. Did participants *experience* less pain when more group memberships were made salient, or simply tolerate it for longer?

J. L. Brown et al. (2003) compared ratings of pain during the cold pressor task when a friend or stranger was present, versus pain alone. They also manipulated the type of contact: active support, passive support, or general interaction (i.e. involving unstructured talk with the other person present). While this study focused on a single interaction partner and not the salience of group membership, the results show that social support can reduce pain reports: compared to pain experienced alone, active and passive support conditions produced significantly lower pain reports than pain experienced alone. However, these effects were observed regardless of whether a friend or stranger was present. Furthermore, participants in the general interaction condition reported *more* pain than the active or passive support conditions, with mean pain levels no different to the alone condition. It is difficult to reconcile these findings with other experimental evidence of increased pain tolerance and reduced arousal when social resources are salient. Ultimately, the findings indicate that how pain is affected by others is not straightforward, and there is a need to consider further whether pain reports in the context of social groups are a function of painfulness, or an adaptive signal of responsive support-seeking.

Measuring Pain Communication and Pain-Related Brain Activation

Pain is complex and multidimensional, and *pain* (a subjective unpleasant sensory and emotional experience) should be distinguished from *nociception* (the activation of pain receptors in the body; International Association for the Study of Pain, 1994/2016). It is important to point out that pain self-reports are generally considered the gold standard in measuring and understanding a person's pain (IASP, 1994/2016); however, this is not without debate. Wager and Atlas (2013) propose that pain self-report is insufficient to characterise the pain experience and the processes underlying pain (see also, J. E. Brown et al., 2011; Wager et al., 2013).

The characterisation of a diagnostic neurologic signature for pain has also been debated (Apkarian, 2013; Legrain et al., 2011; Mouraux, Diukova, Lee, Wise, & Iannetti, 2011; see also, Poldrack, 2006). A wide variety of brain areas are activated when experiencing pain, including the somatosensory cortex, cerebellum, thalamus, insula, cingulate cortex, as well as frontal and parietal areas (Legrain et al., 2011). In this study we were particularly interested in the dorsal anterior cingulate cortex (dACC) and anterior insula (AI) given that these regions across the neuroimaging literature are most consistently implicated when experiencing physical pain (Lamm, Decety, &

Singer, 2011; Peyron, Laurent, & Garcia-Larrea, 2000; Rainville, Duncan, Price, Carrier, & Bushnell, 1997). Insular regions are proposed to subserve representations of physiological states of the body as a foundation of interoception, including specific regions instantiating pain (A. D. Craig, 2002, 2009, 2011; Woo et al., 2014). The dACC is posited to integrate pain, negative affect and cognitive control (Shackman et al., 2011), and dACC activation also maps onto pain sensitivity (Coghill et al., 2003). This makes these regions appropriate candidates to examine the impact of salient group memberships on pain reports and brain activation patterns associated with pain. In an attempt to triangulate measurement, in our research we combine neuroimaging (i.e., the measurement of brain activity as an index of pain) with self-reports of pain.

Overview of the Research

In this study, we examined two ways in which group memberships can act as a psychological resource that affect responses to pain. First, focusing on the notion of pain as a signal of the need for support, we predicted that the more group memberships are made salient, the greater reporting of pain we would find, because more salient group memberships should elicit increased pain communication (H1; communication hypothesis). Alternatively, and rather straightforwardly, salient groups may buffer people from experiencing pain. This would lead to the prediction that the more group memberships are made salient, the less pain people will report (H2; buffering hypothesis). We also examined brain activation in dACC and AI in order to explore whether social group salience would impact pain reports and neural indices in the same way. We specifically looked at the change in these measures between the multiple-group and single-group conditions.

Method

Participants

Twenty participants (4 males) participated in the fMRI experiment (M_{age}= 22.45, *SD* = 1.99 years). All participants had normal or corrected-to-normal vision and cleared tests for MRI safety. We aimed to collect data from a sample of 20 and data collection ceased once this sample size was reached. All participants signed written informed consent and were reimbursed $30 for their participation. The study was approved by the University of Queensland Behavioural and Social Sciences Ethical Review Committee.

Design, Materials and Procedure

The study involved a repeated-measures design. Pain and group salience were manipulated to create four conditions: three painful conditions (*multiple-group*; *single-group* and *multiple-traits*[2]) and one non-painful condition (*control*). Participants presented individually for testing over

[2] For completeness and transparency we describe and report the multiple-traits condition in our Method and Results sections. However, the condition is peripheral to our central hypotheses and is therefore not addressed in detail in the Results and Discussion.

two sessions scheduled no more than a week apart. In the first session, participants were briefed with study information, tested for fMRI safety, and signed written informed consent. Next they were asked to describe four social groups they identified with and that were important to them (for example, groups such as *university friends*, *church group*, *work friends*, or *yoga club*) along with four traits that described them well. These responses were then used to develop stimuli for use in the second session.

In the second session, participants were briefed and invited to enter the fMRI scanner. The fMRI procedure consisted of five repeated functional runs (~8 minutes each), and a structural scan (~5 minutes) between the third and fourth run. At the beginning of each run, participants were presented with the instructions as a reminder. The instructions read: "You will see either: a) 1 group word, b) 4 group words or c) 4 traits presented on the screen during which painful or non-painful stimulation is applied at different intensity levels. During the stimulation try to think about the a) 1 group; b) 4 groups or c) 4 traits." After the instructions at the beginning of each run, a white fixation dot was presented on a black screen for 7.5 seconds, followed by the event sequence. Each functional run consisted of 48 events consisting of the four different conditions (12 events per condition) which lasted 10 seconds per event (see Figure 1).

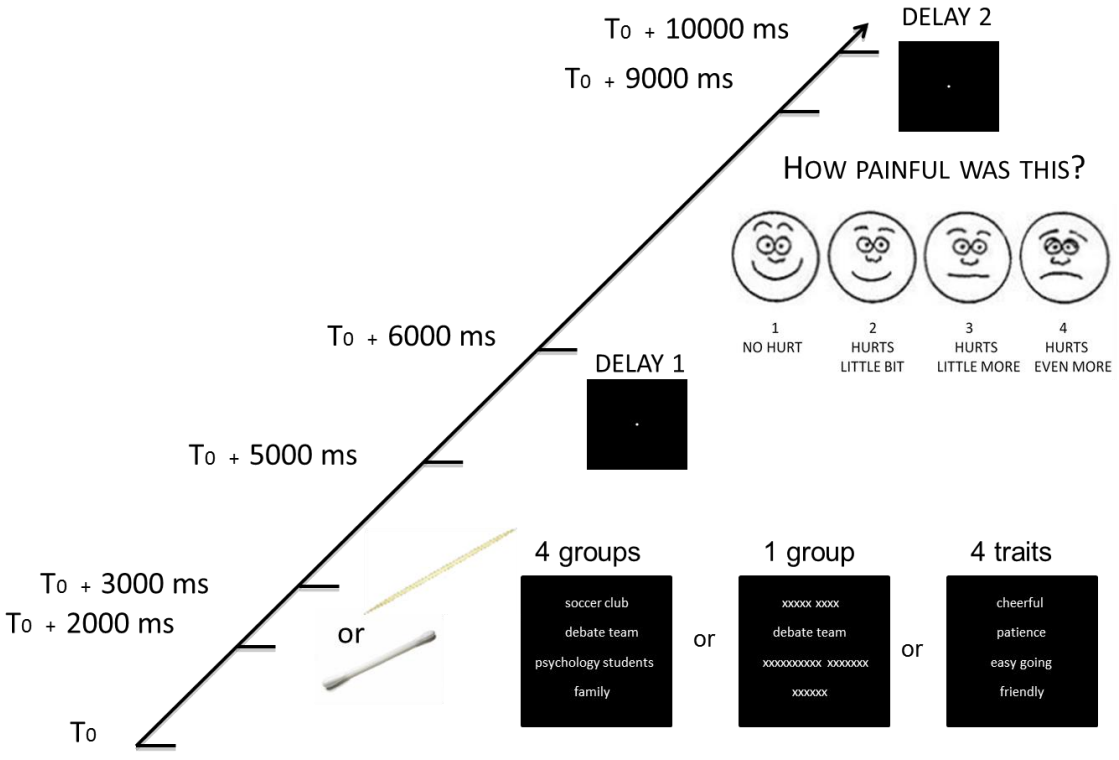

Figure 1. Schematic representation of an event during the fMRI experiment. At the start of the event, participants were presented with their four groups, one of their groups or their four traits for five seconds and during this time had to think about the words presented on the screen. After two seconds, participants received either painful (toothpick) or non-painful (Q-tip) stimulation. After six seconds, participants had three seconds to rate how painful the stimulation was. At the end of the event, a fixation dot appeared on the screen for 1 second.

Group salience manipulation. In the *multiple-group* condition, at the start of each event, the four group-words from the first session were presented underneath each other for a total duration of 5 seconds (Figure 1). During these 5 seconds, participants were instructed to think about their four groups, which ensured that the relevant social resources would be salient during the pain manipulation. In the *single-group* condition a single group-word was presented for 5 seconds together with three lines of Xs which had the same number of characters as the missing words in the multiple-group condition. The Xs were used to match the visual stimulation in the single-group condition with that of the multiple-group condition to minimise differences attributable to variation in visual input. During this condition, participants were instructed to think about the one group. The particular group displayed was pseudo-randomly chosen for each event so that each of the four group-words was presented three times during each run. During the *multiple-traits* condition, the four trait words were presented on the screen for 5 seconds, and participants were instructed to think about these traits. In the non-painful condition, either four group words, one group word or four traits were presented (3 times each per run).

Pain manipulation. During the fMRI experiment, an experimenter was located next to the scanner wearing headphones. To implement the pain manipulation, the experimenter was instructed by two different 1-second beep tones to stimulate the participant's finger for a duration of 1 second. In the three pain conditions, the experimenter applied painful pressure using a toothpick; while in the non-painful condition pressure was applied using a Q-tip. This procedure is similar to one used previously in the literature (Morrison, Lloyd, Di Pellegrino, & Roberts, 2004). Crucially, the experimenter was blind to the presentation of group salience stimuli and unaware which groups condition (multiple-groups, single-group or multiple-traits) the participant was experiencing. Each beep tone was delivered to the experimenter 2 seconds after the start of the event; the stimulation lasted for 1 second so the participant was still thinking about the multiple groups, one group or multiple traits when experiencing the stimulation. After the group manipulation a 1-second fixation point appeared on the screen. Next, participants were given a 3-second response window to rate how painful the stimulation was by pressing one of four possible response buttons. These buttons corresponded with a 4-point rating scale based on the Wong Baker Pain Scale (Wong & Baker, 1988; see Figure 1), from 1 – 'no hurt' to 4 – 'hurts even more'. Both pain rating responses and reaction times were recorded. At the end of the event, a fixation dot appeared for 1 second and then the next trial began. At the end of each run an 8-second fixation point was presented.

fMRI image acquisition. A 3-Tesla Siemens MRI scanner with 32-channel head volume coil was used to obtain the data. Functional images were acquired with the gradient echo planar imaging (EPI) with the following parameters: repetition time (TR) of 2.5 seconds, echo time (TE) of 36ms, flip angle (FA) of 90˚. Thirty-six transversal slices with 64x64 voxels at $3mm^2$ in-plane

resolution and a 10% gap in between the slices covered the whole brain. Whole brain images were generated every 2.5 seconds, and 202 images were acquired during each functional run. The first five images – during which no stimuli were presented – from each functional run were removed to allow for steady-state tissue magnetization. A three dimensional high resolution T1-weighted whole brain structural image was acquired after the third run for anatomical reference (TR = 1900, TE = 2.32ms, FA = 9˚, 192 cube matrix, voxel size = 0.9 cubic mm, slice thickness = 0.9 mm).

fMRI analyses. We used SPM8 software (http://www.fil.ion.ucl.ac.uk/spm/) operated through Matlab (http://www.mathworks.com.au/products/matlab/) to analyze the data. To counter head movements all EPI images were realigned to the first scan of each run. The anatomical image was then coregistered to this mean functional image. To correct for variation in brain size and anatomy between participants, each structural scan was normalised to the MNI T1 standard template (Montreal Neuropsychological Institute) with a voxel size of 1x1x1mm using the segmentation procedure. The same segmentation parameters were then also used to normalise all the EPI images to the T1 template with a voxel size of 3x3x3mm. This process mathematically transformed each participant's brain image to match the template so that any chosen brain region would refer to the same region across all participants. Before further analysis, all images were smoothed with an isotropic Gaussian kernel of 6mm.

As part of the first level of analysis, two general linear models were created for each participant. For each participant in each of the four conditions (i.e., no pain, multiple-group, single-group and multiple-traits), regions with significant Blood Oxygen Level Dependent (BOLD) changes in each voxel were identified using an event-related design time-locked to the time of the stimulation (i.e., model 1; 2 seconds after the start of the event) or at the start of the rating (i.e., model 2; 6 seconds after the start of the event).

In the second level of analysis contrast images for each condition across all participants were included in a factorial design. First a network was identified that was differentially activated for the painful minus non-painful conditions in model 1. We were particularly interested in the dorsal anterior cingulate cortex (dACC) and left and right insula (left AI and right AI) given the fact that these regions are most consistently associated with experiencing pain. Therefore, a region of interest (ROI) analysis was performed within the cingulate cortex and insula (anatomically defined by the WFU PickAtlas program: http://www.fmri.wfubmc.edu/cms/software). This analysis was thresholded at $p < 0.001$, and a voxel-level threshold with a familywise error rate (FWE) of $p < .05$ corrected for the size of the region of interest (ROI) was used to define significant activation. Subsequently, percentage signal change was extracted from the significant regions in this contrast for the three painful conditions for model 1 and 2 using the MarsBaR toolbox (http://marsbar.sourceforge.net/). We were particularly interested to see if people would

communicate their pain more when thinking about multiple versus single group memberships and if this would lead to a relative reduction in dACC and AI activity. If increased pain reporting in the multiple-groups condition is more effective than in the single-group condition, the strongest relative reduction in activation would be present in model 2 (i.e., at the time of pain reporting).

Results

Behavioural Results

Pain rating. A one-way repeated measures ANOVA revealed a significant difference in pain rating between the four conditions, $F(3, 57) = 672.22$, $p < 0.001$, $\eta_G^2 = 0.94$ (Figure 2; Lakens, 2013). As expected, during the no-pain condition, participants reported less pain ($M = 1.04$, $SE = 0.03$) than in the multiple-group ($M = 2.62$, $SE = 0.04$, p <.001), single-group ($M = 2.54$, $SE = 0.03$; $p < 0.001$) and multiple-traits ($M = 2.55$, $SE = 0.05$; p <.001) conditions. Crucially, participants reported feeling more pain in the multiple-group ($M = 2.62$, $SE = 0.04$) than in the single-group condition ($M = 2.54$, $SE = 0.03$; $p = 0.024$, 95% CI_{diff} = [.008, .144]), although the amount of painful stimulation was the same in both conditions. No other differences were significant (see Appendix A for data availability statement).

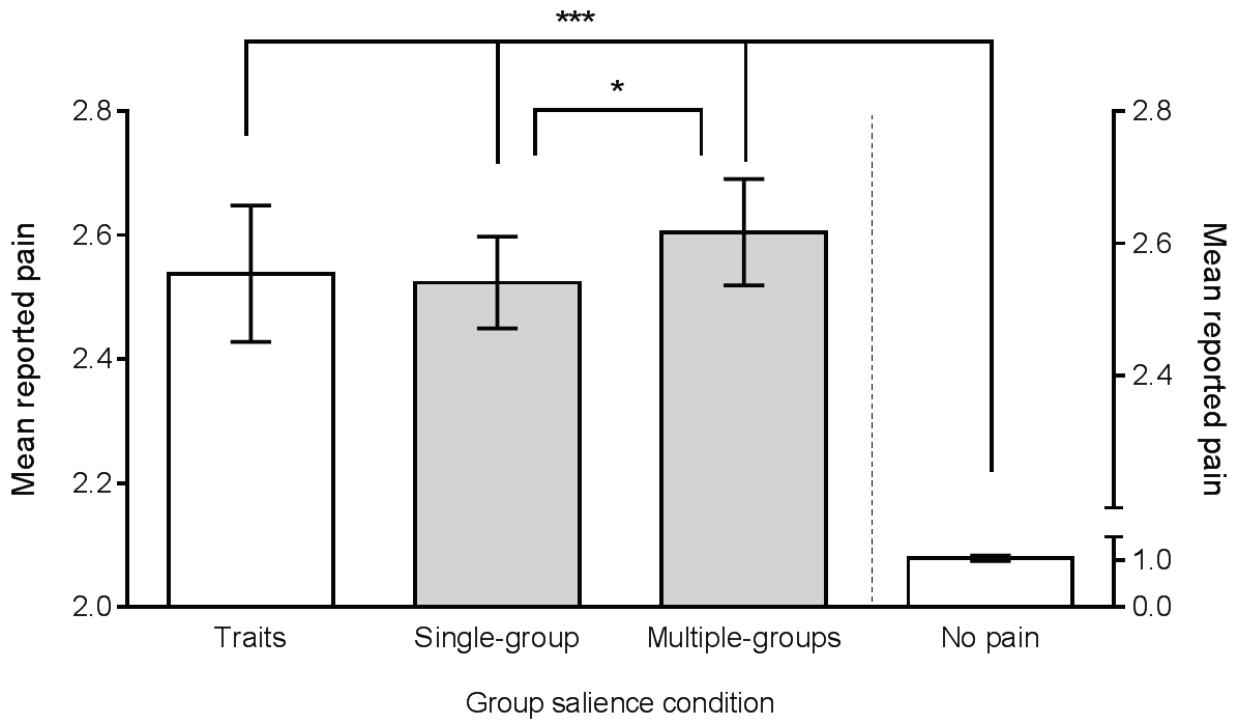

Figure 2. Mean pain ratings for the group salience conditions (no-pain control on the right *y*-axis). Higher scores indicate more pain reporting. Error bars represent 95% confidence intervals. Pairwise comparisons are Bonferroni corrected. *** $p < .001$; * $p = .024$.

Reaction time. A one-way repeated measures ANOVA revealed a significant difference in rating speed between the four conditions, $F(3, 57) = 8.05$, $p < 0.001$. During the no-pain ($M = 841$, $SE = 53$) condition, participants responded faster than in the multiple-group ($M = 947$, $SE = 47$; $p =$

0.04) and multiple-traits (*M* = 959, *SE* = 49; *p* = 0.04) condition but not faster than in the single-group (*M* = 923, *SE* = 50; *p* =.14) condition. No other differences were significant.

fMRI Results

Painful minus non-painful stimulation. Significantly more activation was found in dACC (6, 20, 46; *k* = 93; *Z* = 4.81; *p* = .001), left (-33, 20, 7; *k* = 53; *Z* = 4.01; *p* = .028) and right AI (33, 17, 7; *k* = 25; *Z* = 3.88; *p* = .042; Figure 3A). The % signal was then extracted from these regions combined for the three pain conditions, for model 1 and model 2. A repeated measures ANOVA revealed no difference in activation between the multiple-group (*M* = 0.21, *SE* = 0.05), single-group (*M* = 0.19, *SE* = 0.06) and multiple-traits (*M* = 0.24, *SE* = 0.05) condition for model 1, *F*(2, 38) = 0.98, p = 0.381. A similar repeated measures ANOVA revealed no difference in activation between the multiple-group (*M* = -0.06, *SE* = 0.04), single-group (*M* = -0.06, *SE* = 0.05) and multiple-traits (*M* = -0.01, *SE* = 0.04) condition for model 2, *F*(2, 38) = 1.53, *p* = 0.230. This indicates the pain activation was similar across the three conditions at the time of stimulation and rating, as might be expected given that the amount of painful stimulation was similar across the three conditions.

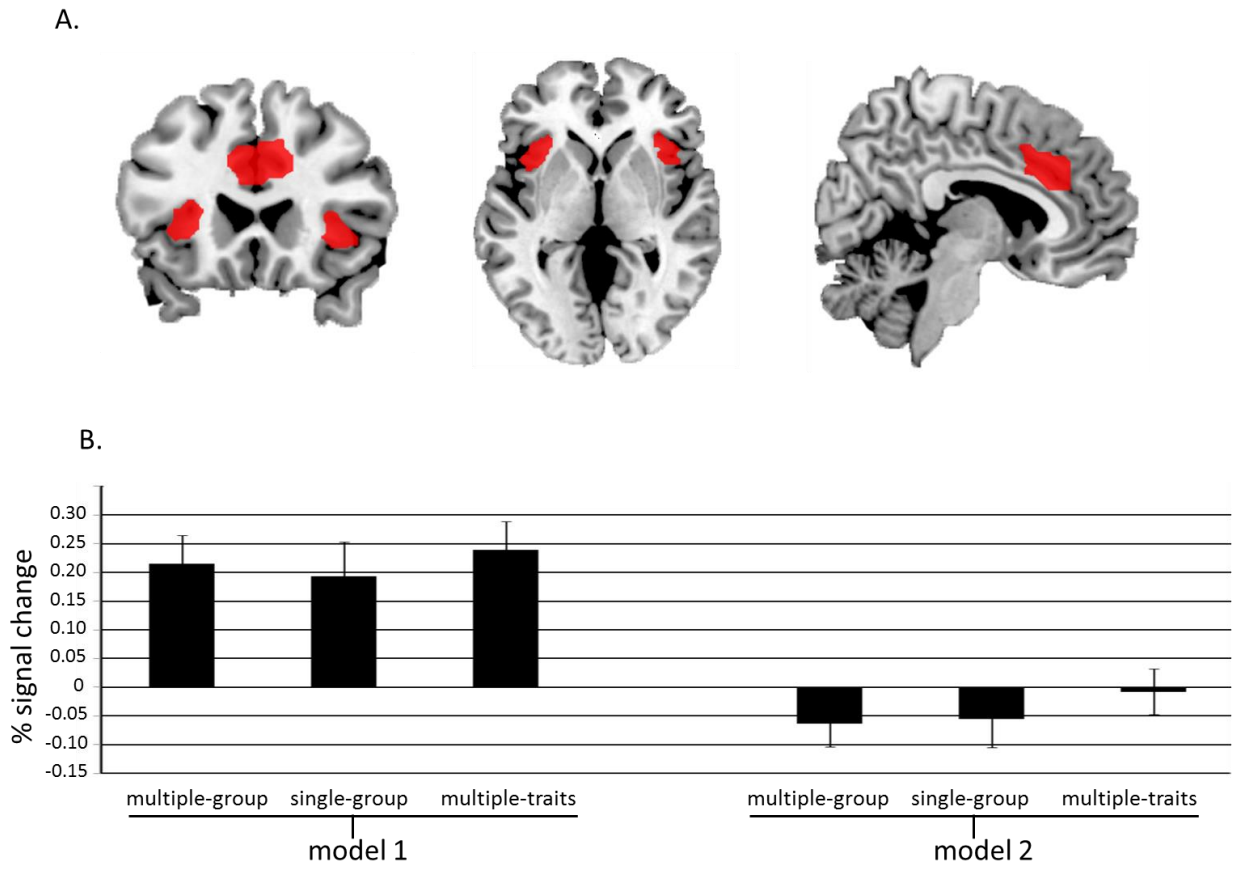

Figure 3. fMRI results. A. Significant brain activation for painful minus non-painful stimulation in left and right insula and dorsal anterior cingulate cortex displayed on a ch2better template using MRIcron software. B. Mean % signal change for activations shown in A for the three painful stimulation conditions at time of stimulation (i.e., model 1) and at the time of the rating (i.e., model 2). Note: The baseline for model 1 and 2 is different (because they represent two different models) and therefore results between model 1 and 2 should not be directly compared against each other.

More relevant is the question of whether increased pain reporting in the multiple- versus single-group condition leads to a relative reduction in dACC and AI activation. To investigate this, the difference in pain rating for the multiple-group minus the single-group condition was correlated with the difference in % signal change for the multiple-group minus the single-group condition (both for model 1 and model 2). A one-way Pearson correlation revealed a marginal negative correlation for model 1, ($r(19) = -.35$, $p = .068$) and a significant negative correlation for model 2 ($r(19) = -.49$, $p = .014$, $r^2 = .24$; Figure 4). This shows that the more participants shared their pain in the multiple-group versus the single-group condition, the less activation was detected in dACC and AI in the multiple-group versus the single-group condition.

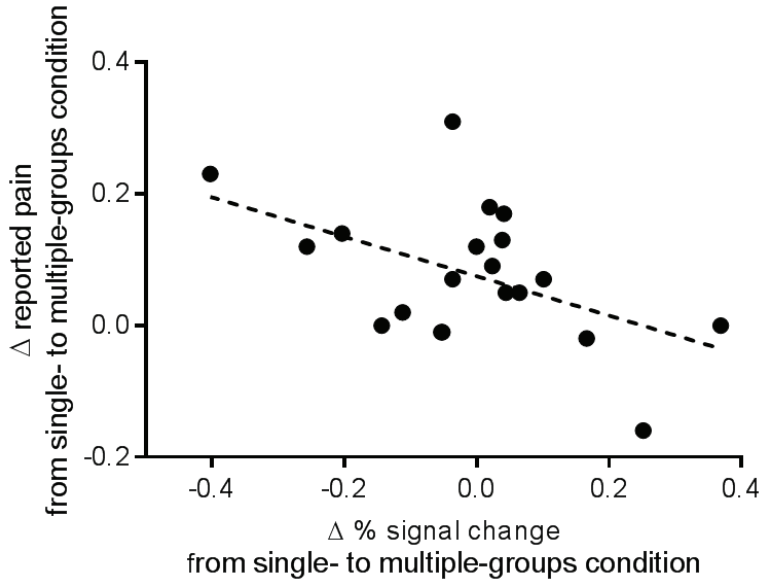

Figure 4. Scatterplot of differences in reported pain and % signal change (model 2) from single- to multiple-group condition. A relative increase in pain reporting as salient group memberships increased was associated with a corresponding relative reduction in dACC and AI activation.

Discussion

Pain is complex, private, and subjective, and the impact of social resources on how pain is experienced and communicated is not yet fully understood. In this study, we manipulated how many group memberships were salient to examine the effect of multiple group memberships on reported and neural indices of pain. We examined evidence for two competing hypotheses: first, that experiencing pain in the context of salient group memberships would lead to greater reporting of pain (H1; communication hypothesis). Second, that the salience of social groups that one belongs to would buffer people from experiencing pain, so that the more group memberships are made salient, the less pain people would report (H2; buffering hypothesis). We also examined brain activation in regions implicated in the experience of pain to explore whether the salience of a varying number of group memberships would impact pain reports and neural indices in the same way.

Behavioural findings were supportive of the communication hypothesis. Rather than a direct reduction in pain reports as a function of group membership salience, behavioural data showed that participants reported increasing levels of pain the more their group memberships were made salient. Specifically, participants reported more pain in the multiple-groups condition compared to the single-group condition. However the number of group memberships alone did not affect dACC and AI activation, which is consistent with the fact that the painful stimulus was the same across pain conditions. Instead, we found that ramping up pain reports as group memberships increased was associated with a corresponding relative reduction in dACC and AI activation. In essence, communicating pain by increasing pain reports in response to changes in social group resources was associated with a greater reduction in these neural indices of pain.

This finding is interesting and shows for the first time that being aware of social resources associated with group memberships enhances the extent to which pain is reported. It also demonstrates that making use of these social resources by increasing pain communication links with a corresponding relative reduction in brain activation in regions associated with pain. This adds to the literature on the role of group memberships as a psychological resource, particularly multiple group memberships (Jetten et al., 2015; Jetten et al., 2014). Social group memberships offer belonging, meaning, purpose, and even 'existential security' (Durkheim, 1912/1995; Greenaway, Cruwys, et al., 2015; S. A. Haslam, Turner, Oakes, Reynolds, & Doosje, 2002; Tajfel & Turner, 1979). This helps to explain why group memberships can provide particularly important social resources in times of adversity.

The present study's findings are also consistent with other work highlighting the psychosocial utility of communicating pain. There are a range of barriers to effectively communicating pain to others (Wager & Atlas, 2013), and pain is routinely underestimated by medical practitioners, parents, carers, and others (K. D. Craig, 2009; Kappesser, de C. Williams, & Prkachin, 2006; Poole & Craig, 1992). However, communication of pain, particularly in the context of ingroups, enhances the likelihood that empathy is aroused and social support is provided (K. D. Craig, 1968; Hadjistavropoulos et al., 2011; A. C. Williams, 2002). The present study points to social group memberships as eliciting pain communication, and that even when invoked distally, the mere psychological availability and salience of social groups membership acts as a resource.

Making use of changes in these resources (i.e. by communicating pain accordingly) appears to impact the pain experience itself, based on brain activation data. The current findings therefore suggest that communicating pain in response to changes in the number of salient group memberships is a particularly functional and adaptive response to the subjective pain experience. Communicating pain is a way to secure the psychosocial resources that ingroup members can provide (see for example, Platow et al., 2007). However, the present study also provides insight into

the potential emergence or maintenance of maladaptive pain responses, such as pain catastrophizing (Sullivan, 2012; Sullivan, Martel, Tripp, Savard, & Crombez, 2006; Sullivan et al., 2001). While there may be immediate benefits for communicating pain when there are more salient social resources, over time these social resources may become tapped, or unilateral signals may be misunderstood. This can lead to a mismatch between pain communication and responder support which can result in suboptimal care experiences and poorer outcomes (Cano, Leong, Heller, & Lutz, 2009; Hadjistavropoulos et al., 2011; Prkachin & Craig, 1995; Sullivan, 2012).

Critically, this study is the first to report a divergence in pain reports and pain-related brain responses and to this extent provides insight into the possibility that these indices of pain are not always in lockstep. Physiological and self-report pain measures might not always overlap and this has implications for how we measure and conceptualise pain (Corns, 2013). The present findings show the informative value of measuring pain using different techniques, as both contribute to the scientific understanding of pain.

The present study also has limitations, such as the constraints on ecological validity inherent to research conducted within fMRI settings. In an effort to address this, we aimed to make the group membership stimuli as relevant and applicable to our participants as possible, by asking participants to nominate the particular groups that were important to them. We also took methodological steps to exclude distraction or inattention as possible explanations for the differences between conditions by ensuring stimuli were visually equivalent. One could argue that even if the visual stimuli are the same, participants might experience more distraction in the multiple-group condition vs. the single-group condition given that the task requires thinking about four groups instead of just one. However, if general distraction were at play, one would expect people to report *less* pain in the multiple-groups condition (because they are more distracted). Instead we find the opposite: people report more pain in the multiple-group condition vs. the single-group condition. We also found no differences in reaction times between the pain conditions. Therefore, it is unlikely that basic distraction could explain the pattern of findings in the present study.

In conclusion, by manipulating the number of salient group memberships that people belong to, we found that participants increased their pain reports when multiple group memberships were salient. However, when participants increased their pain reporting in response to the number of group memberships, there was a corresponding relative reduction in activation in brain regions associated with pain (dACC and AI). These findings point to an adaptive response to pain and suggest that group memberships act as psychological resources that can be brought into play during painful experiences. The more people make use of the social resources they have at their disposal when experiencing pain, the less pain areas are activated.

Chapter 4

Pain serves as a bodily signal of danger or damage, and is typically considered an experience to be avoided or numbed. An emerging literature speaks to the benefits of collective aversive experiences like shared pain; yet there is little research on the psychosocial implications of *enjoying* the aversiveness that results. In this Chapter, I present a field study that examines pain, pleasure, self-revelation and social identification in a collective painful event – a mass winter solstice swim in Hobart, Tasmania. Individuals taking part in the swim were surveyed (N = 194) before and after submerging their bodies in very cold water (approximately 11˚C). Swimmers showed significantly higher levels of social identification following the swim than before, and were more likely to describe their participation as revealing something about '*who I am'.* This self-revelation effect was most strongly evident for those reporting high levels of pleasure and pain, which in turn predicted positive change in social identification over the course of the event. These data demonstrate a role for pleasure and suggest a candidate mechanism for increased identification from intense affective experiences – in other words, pleasurable pain fostered more identification because participants felt more firmly that the event revealed something about who they are.

Chapter 4 is the manuscript in preparation:

Ferris, L. J., et al. (manuscript in preparation). Pleasurable pain promotes increased identification by revealing the self.

Pleasurable Pain Promotes Identification by Revealing the Self

Pain *hurts*. Pain is an unpleasant sensory and emotional experience – an evolved homeostatic emotion that motivates action to protect the organism against damage (A. D. Craig, 2003b; International Association for the Study of Pain, 1994/2016). Pain seeking behaviour implies a failure to adequately respond to pain as a signal of threat to bodily integrity, which on appearance carries risks to survival. On this basis one would not expect humans to seek out or enjoy pain. Philosophers from the utilitarian tradition have long placed pleasure and pain as fundamental drivers of human action, and these experiences have been portrayed as opposites (Bentham, 1789/1907).

However there is reason to expect more to pain and pleasure than this. There are a range of instances where individuals and groups do actually seek out pain – as a rite of passage, in proof of group loyalty, or to show personal attributes like strength or piety (Atran & Henrich, 2010; Glucklich, 2003; Henrich, 2009). The popularity of mass events like the Dutch New Year swims (Niewjaarduik), triathlons and marathons, Coney Island Polar Bear gatherings and cold swims, show that people seek out painful activities (Bleakley et al., 2012; Bridel, 2010; Buijze, Sierevelt, van der Heijden, Dijkgraaf, & Frings-Dresen, 2016). These 'violations of hedonism' hint at the possibility that pain can be positive, perhaps even enjoyed (Fredrickson, 2000, p. 578).

A developing literature has begun to elaborate on the psychosocial benefits of experiences involving pain, particularly in collective group contexts (Bastian, Jetten, Hornsey, et al., 2014). After undergoing pain with others, human beings are more cooperative, prosocial and generous, and feel more connected and identified with others around them (Bastian, Jetten, & Ferris, 2014; Xygalatas et al., 2013). However, despite these effects, there is little research on the implications of enjoyment or pleasure in these collective painful experiences. While sharing painful experiences with others has previously been shown to promote bonding, here we examine the role of enjoyment in this relationship. Furthermore we aim to understand a possible psychological mechanism through which this occurs by focusing on *self-revelation* – i.e. revealing the self.

Shared Pain (And Pleasure) Binds Us

Research on the impact of collective painful experiences has largely drawn on real-life instances of ritualized pain as part of religious and cultural traditions (Konvalinka et al., 2011; Xygalatas et al., 2011; Xygalatas et al., 2013). For instance, Xygalatas et al. (2013) compared charitable giving and social group identification patterns during Hindu festival of Thaipusam in Mauritius after two different forms of mass religious ritual. Participants taking part in the Kavadi, a high-ordeal ritual in which devotees pierce their skin with large skewers and hooks, subsequently went on to donate nearly twice as much money as when taking part in religious prayer and meditation sessions. The painful nature of the high-ordeal experience was key in driving these

prosocial donation outcomes. Specifically, Xygalatas et al. (2013) found that the amount of pain people experienced and reported predicted the dollar value of subsequent charitable giving – the more pain, the more people donated.

Laboratory studies involving naïve groups have also borne out prosocial effects from pain. In three experimental studies with participants randomly allocated to condition, Bastian, Jetten, and Ferris (2014) found greater group cohesion and cooperation in groups who completed painful tasks together (cold-pressor task, hot chilli eating, or wall squats), compared to groups who completed comparable non-painful tasks together. Participants in the pain condition rated their groups as more cohesive, and were significantly more likely to select choices conferring a group benefit in an economic games paradigm. Unlike previous field studies, participants in these experiments were allocated to novel groups without pre-existing religious or social structures to bind them. This suggests that shared pain can facilitate group formation even in the absence of prior social scaffolding, such as religious or social groupings.

To understand the psychological benefits of collective pain, we must also consider how people can derive enjoyment from painful experiences. Enjoyment may arise because pain activates a cascade of endogenous opioids that persists after pain itself has ceased (Leknes & Tracey, 2008; Zubieta et al., 2001). Pain provides a contrastive experience for pleasure (Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993) even leading to 'hedonic flips' where subsequent lesser pains become pleasant (Leknes, Lee, Berna, Andersson, & Tracey, 2011). These pleasurable effects of pain have been linked to enhanced taste sensation (Bastian, Jetten, & Hornsey, 2014) and the tendency to indulge in pleasurable rewards (Bastian et al., 2013). There are also many examples of everyday 'benign masochism' in which negatively-valenced experiences are enjoyable, from relishing scary movies, appreciating 'aggressive victuals' like hot chillies or substances with bitter tastes (Klein, 2014, p. 42), or the elation of a terrifying rollercoaster (Fredrickson, 2000; Rozin et al., 2013; Rozin & Schiller, 1980).

At a group level, sharing intense joy, pleasure and enjoyment in the collective is the essence of what brings human beings together into bonded groups and communities (Ehrenreich, 2006; Fredrickson, 1998, 2004; Haidt, Patrick Seder, & Kesebir, 2008). In anthropological terms, intense collective experiences provide an ecstatic primal foundry for the genesis of deep communal bonds, with Durkheim's *collective effervescence* (Durkheim, 1912/1995) and Turner's notion of *communitas* (Haidt et al., 2008; E. Turner, 2012; Wiltermuth & Heath, 2009). In line with the evidence that people do indeed seek out and enjoy painful experiences, we next consider how enjoyment might contribute to social bonding between individuals in painful contexts.

Why do intense experiences lead to social bonding and identification?

Although well documented, the psychological mechanism through which intensely painful or pleasurable experiences might facilitate social bonding remains unexamined. While some have argued for the effects of memory (Richert et al., 2005) or attentional focus (Bastian, Jetten, & Ferris, 2014) there is as yet no empirical consensus on how such experiences might increase feelings of bondedness and identification with others. One line of work has argued that participation in extreme rituals, such as those involving collective pain, provides a signal to others about our values or attributes (Atran & Henrich, 2010; Watson-Jones & Legare, 2016) – in essence, revealing social information to others around us about who we are. Considering cognitive processes at the individual level, Fredrickson (2000) proposed that moments of peak affect evoke the most meaning-making and reveal information to oneself about 'how much you can handle' (p. 592) – providing evidence of a person's own vulnerabilities and abilities to contend with the vicissitudes of experiential life. Perhaps together then, these intensely painful yet pleasurable collective experiences subjectively reveal the self, and help us to understand who we are.

The Current Study

The present work examines pain, pleasure, self-revelation, and identification in the context of a collective naked cold swim during the southern hemisphere winter solstice. Exposure to and immersion in very cold water places considerable demands on physiology of the body (Pendergast & Lundgren, 2009), and is generally considered painful. We examined whether the collective cold swim was experienced as painful and pleasurable, and what identity functions this would serve in terms of self-revelation and social identification.

Shared pain promotes social bonding, and intense affective experiences reveal social and identity-relevant information to ourselves and others around us. We therefore expected swimmers would feel a stronger sense of social identification with others following the swim, and feel more firmly that the event revealed something about who they are. We then examined the role of pain and pleasure in predicting such changes. With the premise that pain and pleasure may not be mutually exclusive, we tested whether pain, pleasure, and their interaction would predict changes in self-revelation and social identification arising from the swim. Finally, we were interested in exploring the processes behind such changes— i.e. whether self-revelation engenders increased social identification.

Method

Participants

The final sample comprised 194 members of the general public taking part in the Winter Solstice Swim at the Dark Mofo Winter Festival in Hobart, Tasmania, Australia. Participants ranged in age from 19 to 76 years (M_{age} = 43.08 years, *SD* = 13.60; 118 female, 73 male, 3 did not

specify). All swimmers were invited to participate online via email from the event organizers, with follow-up recruitment by study representatives onsite before and after the event. All participants provided informed consent. We aimed to collect approximately 200 participants with matched pre-post data. A total of 277[3] provided data in the pre-event survey, while two participants provided post-event responses without completing the pre-event survey. Swim participants with complete but unmatched data from either time point were excluded, $N = 83$), leaving a final sample of 194 participants with matched pre- and post-event data (attrition rate of 30%). No significant differences were found in time 1 variables for the attrition group versus the adequately sampled group ($ps > .09$).

The final sample represents approximately 26% of all swimmers reported by organizers on the day ($N = 752$). All participants were offered entry into a prize draw for a $250 voucher as an incentive for their participation. Ethical clearance was given by the University of Queensland's School of Psychology Ethics Review Committee and methods were carried out in accordance with the relevant guidelines and regulations.

Design, Measures, and Materials

We employed a repeated-measures design with surveys administered before and after the event. At both time-points, the survey measured self-revelation (how much participation in the event reveals something about who I am); social identification (identification with other swimmers and the festival, connection and trust); and demographics. The post-event survey asked about the degree of pain and pleasure during the event, the duration of immersion, and current pain at the time of completing the survey.

Pre-event survey. Participants had the option to undertake an online or hardcopy survey. In both formats, participants were asked to provide a valid email address in order to receive the post-event survey, and to confirm the event they were about to attend. Next a series of brief questionnaire items measured identification, social connection, and trust, each along a seven-point scale from (1 – *Not at all* to 7 – *Very much* so)[4]. Two items measured identification with other

[3] This excludes participants who did not specify or attend a relevant event ($N = 24$); or provided only an email address in the pre-event survey and no substantive response on any of the key measures of interest ($N = 20$). No significant differences were found in time 1 variables for those who provided substantive responses in the attrition group versus the adequately sampled group.

[4] Pre- and post-event questionnaires also measured additional variables not reported here for brevity (see Supplementary Materials; Appendix B). These measures include two pictorial items relating to identity fusion with other swimmers and the festival (Swann, Gómez, Seyle, Morales, & Huici, 2009; Swann, Jetten, Gomez, Whitehouse, & Bastian, 2012); two items on self-esteem and meaningful existence (*I feel good about myself*; *My existence is meaningful*) linked to fundamental psychological needs (K. D. Williams, 2007b); one item on the extent to which participation in the event allowed participants to get back to basics; and two items relating to similarity and connection with animals (Amiot & Bastian, 2015, 2017).

swimmers and identification with the festival overall (adapted from Postmes, Haslam, & Jans, 2013; for example, *I identify with the other people at this event*, *I identify with Dark Mofo*); two items measured connection with and trust in others taking part in the event (*I feel a strong connection to other people at this event*; *I can trust the other people at this event*). These items were combined to create a single variable of social identification ($\alpha = .82$). One item measured revealing the self (*Taking part in this event shows something about who I am*). Finally, participants provided age and gender details, and generated a unique code for pre- and post-event survey matching.

Post-event survey. The online survey link was emailed to all participants who provided a valid email address in the pre-event survey. Participants also had the option to undertake the survey in hardcopy onsite with study representatives. The post-event survey included the same items concerning self-revelation, social identification ($\alpha = .86$), demographics, and asked participants to generate a unique code, with the addition of three items concerning pleasure and pain from the event (*How pleasurable was the event?*, *How painful was the event?*) and painfulness at the present time (*I am feeling pain right now*) on the same 7-point scale. Participants were also asked to indicate how long they had remained in the water, were probed for insight (*Do you know what this study is about?*), and were given the opportunity to provide any additional comments in an open text box response format.

Procedure

Solstice swim. All swim participants were required to register with event organizers before taking part in the swim. Registered swimmers were invited to participate in the study by event organizers via an email approximately one and a half days before the swim. The email provided links to study information and the pre-event survey link. The pre-event survey was closed once the swim began.

The swim was held at sunrise on the banks of the Derwent River at Long Beach, Sandy Bay, Hobart on the morning of the winter solstice (22 June 2015). The ambient air temperature was 0.8˚C and water temperature approximately 11˚C. Swimmers were provided with caps and towels by event organizers, changed out of their clothing, and waited on the shore in towels until invited to disrobe and enter the water by officials at the rising of the sun. Gongs were sounded and colored smoke flares fired as swimmers entered the water en masse. Swimmers were free to remain in the water as long as they wished; there was the option to swim out to buoys located approximately 50m offshore, or simply to enter the water with others as desired. Organizers reported a total of 752 swimmers on the day. The post-event survey link was emailed immediately after the swim was completed. Participants were encouraged to fill in the survey as soon as possible after finishing the event. Participants completed the survey, and were debriefed and thanked for their participation.

Analytical strategy. Participants' pre- and post-event responses were matched using their unique code and crosschecked with other data fields where possible to prepare for analysis. Once responses were matched we examined descriptive statistics and post-event survey lag. To test our hypotheses regarding pain, pleasure, self-revelation and identification, we conducted paired t-tests to discern pre- to post-event changes in the key outcome measures of self-revelation and identification attributable to the event itself. We then tested pain and pleasure as specific predictors of these changes with regression analyses.

Results

Pain and Pleasure

Mean pleasure experienced during the event was above the mid-point at 6.13 (*SD* = 1.28), while mean pain experienced during the event was reported at 4.15 (*SD* = 1.95; see Table 1). Mean current pain reported at the time of actual survey completion was 1.88 (*SD* = 1.58). Figure 1 shows the two-dimensional co-distribution of pleasure and pain ratings of the swim. Pain ratings were platykurtic while pleasure ratings were negatively skewed and showed evidence of ceiling effects, indicating that the majority of participants indeed found the swim pleasurable.

Table 1.

Descriptive statistics and correlations for swim experience characteristics and response lag.

		Correlation			
	M (SD)	1	2	3	4
1. Pain	4.15 (1.95)				
2. Pleasure	6.13 (1.28)	-.21**			
3. Duration of exposure	157 (135)	-.17*	.15*		
4. Post-event response lag	251 (233)	-.10	-.20**	-.13	
5. Pain now	1.88 (1.58)	.52***	-.10	.00	-.32***

Note: Correlations are Spearman's rho for variables treated non-parametrically. *** $p < .001$; ** $p < .01$; * $p < .05$ (two-tailed).

Duration of exposure. Data on swim duration was obtained for 97% of the cleaned and matched dataset (n = 188). Reported immersion time ranged from 15 seconds to 15 minutes (M = 157 seconds, SD = 135). Duration of exposure was negatively related to pain (ρ = -.17, p = .020) and positively correlated with pleasure (ρ = .15, p = .041), suggesting that immersion time i.e. stimulus exposure is not an analogue for painfulness or pleasure in this setting.

Timing of post-event responses. The post-event lag for responses to the second survey ranged from approximately 16 minutes to 16 hours 50 mins post-swim (M = 251 mins, SD = 233). Approximately 75% of the cleaned and matched sample (n = 146) completed the survey within six hours of the swim, with approximately 50% responding within three hours. A longer delay post-

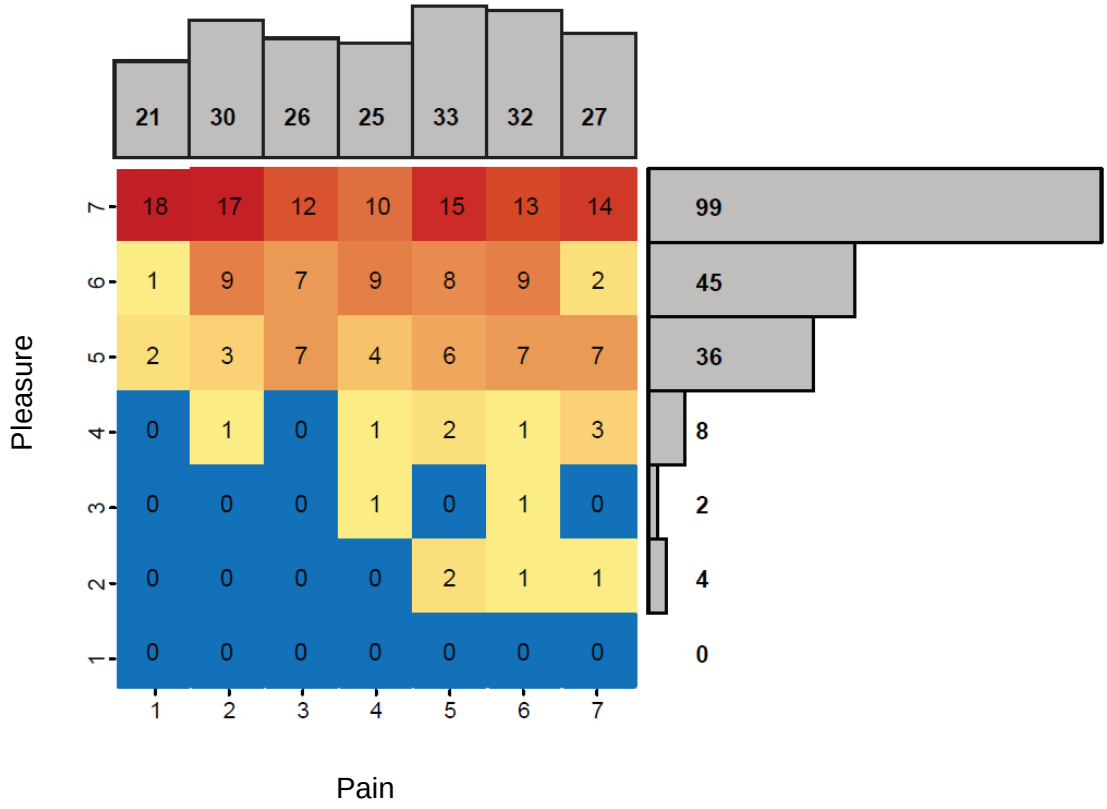

Figure 1. Co-distribution of pain and pleasure reports arising from the swim. Centre panel shows two-dimensional histogram of pain and pleasure ratings from 1 (*not at all*) to 7 (*very much so*), with count data embedded in heatmap. Horizontal axes show pain distribution with count data; vertical axes show pleasure distribution with count data.

event was associated with ratings of lower pleasure during the event (ρ = -.20, p = .004) and lower pain at the time of survey completion (ρ = -.32, p < .001), but was not related to ratings of painfulness during the event (ρ = -.10, p = .179).

Pre- to Post-Event Changes

Paired *t*-tests (see Table 2) revealed a significant increase from pre- to post-event for outcome measures relating to self and others. Significant positive change from pre- to post-event was seen in self-revelation (M_{pre} = 5.37, SD =1.69, M_{post} = 5.73, SD = 1.359, d = .25). Social identification increased pre- to post-event (M_{pre} = 4.60, SD = 1.36, M_{post} = 5.38, SD = 1.24, d = .65); and this was also the case for each underlying item, with a significant increase in trust in others (M_{pre} = 4.94, SD = 1.57, M_{post} = 5.55, SD = 1.46, d = .45), connection with others (M_{pre} = 4.15, SD = 1.84, M_{post} = 5.30, SD = 1.52, d = .67), identification with other swimmers (M_{pre} = 4.49, SD = 1.74, M_{post} = 5.45, SD = 1.50, d = .53), and identification with the festival (M_{pre} = 2.93, SD = 1.13, M_{post} = 3.18, SD = 1.05, d = .27).

Table 2.

Pre- and post-event descriptive statistics, paired t-test outcomes, and effect size for self-revelation and social identification variables.

	M (SD)							
	Pre-event		Post-event		*t*	*p*	95% CI of the difference	*d*
Self-revelation	5.37	(1.69)	5.73	(1.35)	3.45	.001	[.157, .575]	.25
Social identification	4.60	(1.36)	5.38	(1.24)	9.00	<.001	[.608, .949]	.65
Trust	4.94	(1.57)	5.55	(1.46)	6.18	<.001	[.414, .802]	.45
Connection	4.15	(1.84)	5.30	(1.52)	9.23	<.001	[.900, 1.389]	.67
Identification with swimmers	4.49	(1.74)	5.45	(1.50)	7.41	<.001	[.703, 1.214]	.53
Identification with festival	2.93	(1.13)	3.18	(1.05)	4.27	<.001	[.216, .588]	.27

Next, we tested whether subjective pain and pleasure during the event predicted change in the outcome variables of self-revelation and identification. We first tested the relationships between positive change in self-revelation, and pain and pleasure experienced during the event with regression analyses. We found a marginal main effect of pain on change in self-revelation (b = -.68, t = -1.96, p = .051, 95% CI [-1.359, .0035]), no main effect of pleasure (b = -.29, t = -1.02, p = .309, 95% CI [-.839, .267]), and a significant pain-pleasure interaction (b =.12, t = 2.21, p = .028, 95% CI [.013, .225]). Simple slopes analysis showed a conditional positive effect of pleasure at high (+1SD) pain (b = .44, t = 3.88, p < .001, 95% CI [.216, .663]) but not low (-1SD) pain (b = -.02, t = -.14, p = .888, 95% CI [-.367, .318]); such that positive change in the self-revelation motive was maximized when both pain and pleasure were high (see Figure 2). Johnson-Neyman regions of significance analysis showed the conditional effect of pleasure on self-revelation motive was significant when pain ratings reached a value of 4.12 and above (Figure 3).

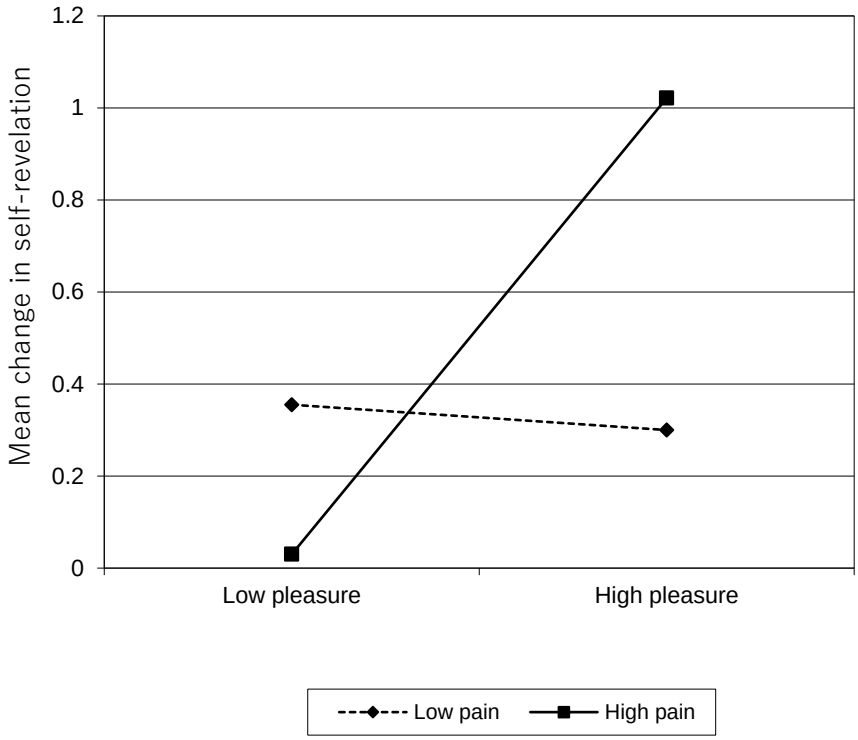

Figure 2. Plot of simple slopes showing mean change in self-revelation motive at low (-1SD) and high (+1SD) pleasure and pain.

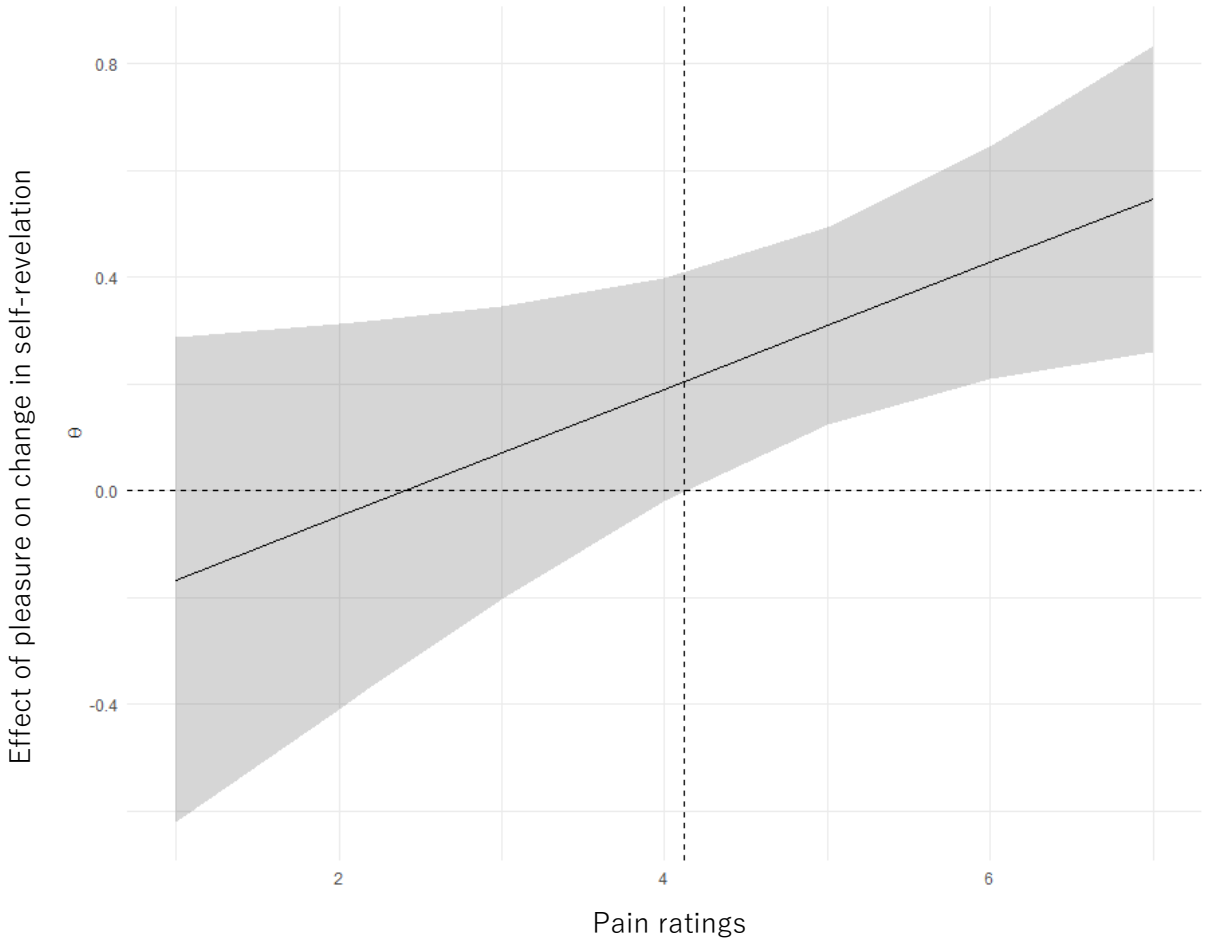

Figure 3. Johnson-Neyman analysis of regions of significance showing that the effect of pleasure on change in self-revelation is non-zero at pain ratings of 4.12 or greater.

We also tested whether pain, pleasure and their interaction term predicted changes in social identification over the course of the event. For social identification, traditional regression analyses did not reveal a significant effect of pleasure, pain, or pleasure-pain interaction on positive change in social identification (*p*s > .13). Johnson-Neyman regions of significance analysis showed a significant conditional effect of pleasure on change in social identification when pain ratings were equal to a value of 4.77 and greater, reflecting the contribution of pain and pleasure in explaining variance in social identification at levels higher than mean pain, noting that these variables were not normally distributed.

We then examined the processes underlying changes in social identification arising from the swim. Given the theoretical rationale that 'revealing the self' connects us with others, we undertook process analyses to examine whether the pleasure-pain effect on self-revelation might explain the changes in social identification over time (see Figure 4). We used the PROCESS macro (Model 7) with 5000 bootstrapped samples to test a moderated mediation in which pleasure served as the predictor, pain as the moderator, positive change in self-revelation as the mediator, and change in social identification as the outcome variable (Hayes, 2015). This analysis revealed a significant conditional indirect effect, in which the interaction of pleasure and pain predicted increased social

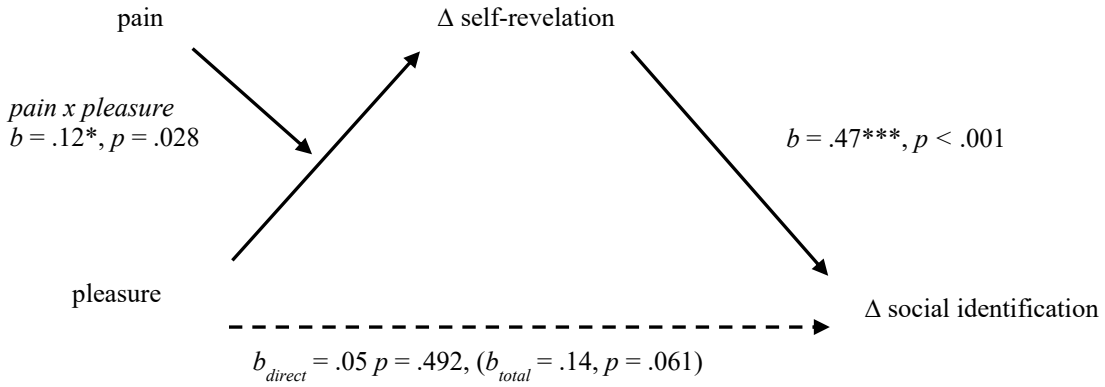

Figure 4. Process model showing a conditional indirect effect of pain and pleasure on positive change in identification via change in self-revelation. At high pain (+1SD): *IE* = .1558, *SE* = .0598, 95% CI [.0717, .3131]; at low pain (-1SD), *IE* = -.0087, *SE* = .0794, 95% CI [-.1998, .1198]. Index of moderated mediation = .0422, *SE* = .029, 95% CI [.0030, .1177], R^2 = .07.

identification through positive change in self-revelation (index of moderated mediation = .0422, *SE* = .029, 95% CI [.0030, .1177], R^2 = .07). In other words, pleasure served as a significant non-zero predictor of this process only when pain was high (+1SD; *IE* = .1558, *SE* = .0598, 95% CI [.0717, .3131]). When pain was low (-1SD), the indirect effect of pleasure could no longer be considered non-zero (*IE* = -.0087, *SE* = .0794, 95% CI [-.1998, .1198]).

Because our study design does not permit definitive inferences of causality in the order of these processes, we also tested an alternative model *post hoc*, in which social identification was substituted as the mediator, and self-revelation served as the outcome variable. Neither pain, pleasure, nor their interaction predicted the *a* path to the mediator (social identification) in this alternative model, suggesting that changes in social identification do not explain the pain-pleasure effect on self-revelation.

Discussion

As we come to better understand the benefits of collective pain, it is important to understand the implications of enjoyment also. This study aimed to unveil the role of pleasure in the context of a painful collective activity, and to examine links between pleasure, pain, self-revelation and social identification with participants undertaking a mass naked cold swim. Consistent with previous research on shared pain (Bastian, Jetten, & Ferris, 2014; Xygalatas et al., 2013), our results showed a significant increase in social identification over the course of the swim. Participants felt more bonded and identified more strongly with others after sharing a painful collective activity together. Underlying this finding, we found increased trust and connection with other swimmers, and identification with other swimmers as well as the overall festival including non-swimmers.

We also found that participants experienced a greater sense of self-revelation following the swim. This self-revelation effect was significant at the cohort level from pre- to post-swim, and was

most strongly evident for those reporting high levels of pleasure and pain from the swim. Experiencing high pain *and* pleasure in this collective activity predicted positive change in self-revelation. In turn, increased self-revelation then explained positive change in overall social identification. These data suggest a candidate mechanism for increased social bonding from intense affective experiences – in other words, that pleasurable pain fostered more social identification because participants felt more firmly that they had revealed something about who they are.

The present study offers a real-life exemplar of benign masochism and provides an insight into what participants stand to gain from pain and its enjoyment. For those of us watching from the shore, collective painful events like cold swims can appear striking because of the extreme nature of the activities involved; pleasure or enjoyment can seem like a distant and unlikely prospect. In explaining our results, one possibility is that pleasure simply makes pain more bearable. Studies on cognitive modulation of pain have examined the value of distraction and positive affect in reducing painfulness (Villemure & Bushnell, 2002). Pleasant diversions amuse and attract attention, redirecting cognitive resources away from pain and towards alternative positively-valenced stimuli (Villemure & Bushnell, 2009). However, these and similar studies involve experimentally-induced and additional pleasant stimulus, such as scent or positively-valenced images, rather than obtaining pleasure in a painful experience in and of itself. Our data suggest that people can report the same activity as both highly painful, and highly pleasurable, when given the opportunity to do so – and that when this is the case, people feel more firmly that the self is revealed.

Our results also suggest that rather than escaping or losing the self (Baumeister, 1988; Ehrenreich, 2006), taking part in the swim *reveals* the self. The novelty of our results lies in the notion that experiencing pain and pleasure together can generate this greater sense of self-revelation. Intense affective experiences provide peak moments of great salience and meaning-making value, in which we reveal socially relevant information to others, and which convey information about vulnerability or capacity within ourselves (Fredrickson, 2000). We also found evidence of the self-revelation effect as a candidate mechanism for increased social identification from shared intense experiences. The present findings suggest that experiencing intense pleasure and pain serves identity functions and establishes much more than propinquity – revealing the self and binding the individual to others.

More broadly, the present findings also speak to the importance of social context in understanding the function of shared mixed-valence experiences like pain and pleasure. Much of the psychological research has examined painful collective practices in the context of established religious, sporting, or social groups in which one is already a member (Bridel, 2010; Cohen, Ejsmond-Frey, Knight, & Dunbar, 2010; Drury, 2012; Konvalinka et al., 2011; Vezzali, Drury, Versari, & Cadamuro, 2015; Xygalatas et al., 2011; Xygalatas et al., 2013), or as a means of

initiation into valued groups (Mann et al., 2015). Although there are now a number of studies into shared pain and its benefits, these explorations have not asked participants about pleasure.

This study demonstrates the effects of pain and pleasure on self-revelation with a medium-sized sample in a field context outside the laboratory. We have proceeded with the assumption that pleasure and pain are not mutually exclusive, and may be experienced together and measured discretely (Larsen, McGraw, Mellers, & Cacioppo, 2004). Importantly too, our findings relate to agentic pain – pain that is freely and consensually chosen. Some research has focused on collective survival and growth through adversities such as natural disasters and emergencies (Drury, 2012; Drury, Cocking, & Reicher, 2009; Vezzali et al., 2015). These are often tragic circumstances where pain and suffering is visited upon individuals and groups – certainly not welcomed, much less enjoyed. It would be incongruous to presume that enjoyment plays a role in such circumstances.

The inherent restrictions of field surveying have meant our study design is absent a control group which would better allow causal inferences, and does not allow us to establish precisely how pain and pleasure might operate to create these effects in real time. While we identified significant changes over time, we did not find a main effect of pain in our process models, in the absence of a no-pain comparison (Bastian, Jetten, & Ferris, 2014; Xygalatas et al., 2013); and ultimately, we identified an interaction which would qualify any main effects. Recalling mixed emotions represents a cognitive summary of past experience, and is vulnerable to decay over time (Aaker, Drolet, & Griffin, 2008). We relied upon self-report ratings of pain and pleasure after the event, which makes it difficult to unpack expectancies and subjective experience from post-hoc reappraisal, or to understand how pain and pleasure vary over time during the event. Live experiential tracking and real-time physiological correlates could add valuably to the empirical foundations the current research sets down.

Conclusions

In sum, pain and pleasure have both received extensive philosophical and empirical consideration as fundamental human experiences. However, the present research is among a small handful of studies examining the combination of pain and pleasure in the field. This research challenges the assumption that pleasure and pain are mutually exclusive, unlocking fascinating new territory in how people benefit from painful and pleasurable experiences in the collective. Henrich (2009) observed that activities involving high levels of pain carry significant physical and emotional costs, which seem to render them unsustainable from an evolutionary perspective; but psychological and social dividends may indeed be found on further inspection. We have shown one instance where such benefits are apparent. For those participants who take part, it seems that going through pain *and* pleasure together is a chance to meet those most fundamental of human needs – to reveal who we are, and to help us feel connected with those around us.

Chapter 5

Pain enjoyment has historically been relegated as perverse, pathological or as a sexual predilection shared by few. However, research also shows that pain enjoyment occurs in normative, non-pathological and non-sexual domains such as sport, and cultural and religious rituals. A growing collection of research, including this thesis, has advanced the notion that pain may be beneficial, and for this reason people may seek out and even enjoy pain. What remains to be examined is how pain enjoyment is perceived by *others*, whether it comes with immoral connotations (as case examples might suggest), and what underpins any moral judgements of those who do enjoy pain. This chapter therefore undertakes an empirical examination of the moral status of pain enjoyment, and tests two related mediating pathways of unconventionality and disgust to explain why pain enjoyment may attract moral downgrading. In 2 studies, online respondents rated vignettes describing individuals undertaking enjoyable activities that were either painful or not (Study 1); or painful activities that were enjoyable or not (Study 2). Results showed that pain enjoyment consistently attracts judgements of lower moral status and that unconventionality and disgust statistically mediated the moral downgrading of pain enjoyment.

Chapter 5 is the manuscript in preparation:

Ferris, L. J., et al. (manuscript in preparation). Pleasurable pain is morally diagnostic and attracts moral penalties.

Pleasurable Pain is Morally Diagnostic and Attracts Moral Penalties

Pain and pleasure are basic percepts that are fundamental to human experience – distinct, recognisable, and reasonably familiar to us. When combined however, pain and pleasure elicit a vexed philosophical and moral quandary (Baumeister, 1988, 1989/2014). Even though pain enjoyment can be observed in normative and non-sexual settings (Ferris, Jetten, & Bastian, manuscript in preparation; Klein, 2014; Rozin et al., 2013), historically, pain enjoyment has attracted moral condemnation and has been described as deviant, perverse, or pathological (Brenner, 1959; Freud, 1929). In the present work we examine the perceived morality of pain enjoyment. We empirically test the notion that people enjoying pain may be morally downgraded by observers, and investigate perceived strangeness and disgust as two potential mediators of this effect.

Pleasure and Pain

Pain is ubiquitous and important for survival – it captures attention and motivates action, typically avoidance (A. D. Craig, 2003b; Eccleston & Crombez, 1999; Fernandez & Turk, 1992). Pain provides information about threats to the body and flags a potential breach of bodily integrity. Despite this, at times pain is associated with positive attributions and outcomes. For instance, pain attracts diverse meanings (Aldrich & Eccleston, 2000) that may not only be associated with damage and destruction (Scarry, 1985), but are also linked to positive growth, stoicism, or cleansing (Bastian et al., 2011; Bastian, Jetten, Hornsey, et al., 2014).

While pain may deliver positive outcomes, enjoying pain itself is counterintuitive. It is therefore worthwhile to address the question of how pain can ever co-occur with pleasure. Research has indicated that people do show a propensity to enjoy a range of negatively-valenced experiences, including pain. In describing the phenomenon of 'benign masochism', Rozin et al. (2013) identified a range of normative exemplars of aversive and negatively-valenced experiences from which pleasure can arise, such as enjoying sad or scary movies, or imbibing bitter, sour or astringent food and drink. Similarly, there is evidence of pain enjoyment in the context of sport and other physical challenges (Bridel, 2010; Gard & Meyenn, 2000); childbirth (Norr, Block, Charles, Meyering, & Meyers, 1977); and 'aggressive victuals' such as chilli-eating (Klein, 2014; Rozin, Gruss, & Berk, 1979; Rozin & Schiller, 1980). Pleasurable pain also attends some extreme devotional or religious activities, such as ecstatic devotion or possession (Glucklich, 2003), in which painful activities such as flagellation are undertaken to ostensibly induce a state of elevation in which participants feel spiritual connection to their deity.

In their review of the positive consequences of pain, Bastian, Jetten, Hornsey, et al. (2014) suggested that pain itself facilitates pleasure, for example through making bodily experiences salient (Bastian, Jetten, & Hornsey, 2014; Scott, Cayla, & Cova, 2017); as a contrastive experience

(Kahneman et al., 1993; Leknes et al., 2013), or even through moral licensing of indulgences after unfair pains (Bastian et al., 2013). Recent empirical findings indicate that experiencing pain *and* pleasure in collective settings can promote connection and serve identity functions by revealing who we are (Ferris et al., manuscript in preparation). Together, these provide a range of reasons why pain may attract positive associations, even pleasure.

Having briefly reviewed evidence of the various links between pleasure and pain, the next step is now to consider how onlookers regard this phenomenon – what is its moral status from the perspective of observers? We therefore next consider the moral relevance of pain enjoyment from the perspective of the observer.

Attracting Moral Judgments From Observers

Pain enjoyment is a salient affective display from which observers may infer moral qualities. Social observers are highly motivated to obtain information about the moral qualities of others (Uhlmann, Pizarro, & Diermeier, 2015). Affective states and displays provide social information of moral relevance that the observer can utilise to make inferences about the moral character of the target, and their propensity to undertake relevant behaviours that signal character (Szczurek, Monin, & Gross, 2012; Uhlmann et al., 2015; Watson-Jones & Legare, 2016). Judgments of others' moral qualities reference the thoughts and deeds a person is inclined to undertake (give to charity, cheat others), and a person's character, such as whether they are honest or fair (Aquino & Reed, 2002; Chakroff, Dungan, & Young, 2013; Uhlmann & Zhu, 2013). As one form of affective display, pain displays have substantial communicative value and are highly salient to others (Hadjistavropoulos et al., 2011; A. C. Williams, 2002). In short, observers are motivated to make sense of affective states like pain enjoyment, and moral judgements concerning character and proclivities are one way this motivation may be actioned.

What specifically about experiencing pain and pleasure in combination would inspire moral judgements about a person? Socio-moral norms provide one explanatory account (Haidt, Rozin, Mccauley, & Imada, 1997; Rozin, Lowery, Imada, & Haidt, 1999). According to this account, breaches of socio-moral norms violate shared understandings about right and wrong (Rozin et al., 1999). With reference to pain and enjoyment, it is normative for pain to involve unpleasantness and even suffering, rather than enjoyment. Pain is aversive and typically *un*pleasant (Auvray et al., 2010; A. D. Craig, 2003a; Fernandez & Turk, 1992; Price, 2000). On this basis, enjoying pain may be anti-normative and run against people's basic intuitions about what is right and wrong in reference to pain itself. In other words, a person experiencing enjoyment with pain represents a violation of socio-moral norms about pain, and therefore would attract moral downgrading from observers.

If so, there remains a need to explain what might specifically drive such moral judgments. Two potential candidates emerge from the morality literature. First, the idea that pain enjoyment is unconventional or strange is one hypothesis. Although not all strange things are perceived to be immoral, many behaviours judged to be immoral are also ostensibly strange (Gray & Keeney, 2015). Quite straightforwardly, the hedonic mismatch of painfulness and enjoyment may breach socio-moral norms, and attract moral downgrading because it is perceived to be unconventional. Second, disgust is a valid candidate for why pain enjoyment could attract moral downgrading. Disgust is a moral emotion that is elicited by violations of socio-moral norms (Haidt et al., 1997; Simpson, Carter, Anthony, & Overton, 2006), as well as bodily incursions (Bentham, c1785/1978; H. A. Chapman, Kim, Susskind, & Anderson, 2009; Rottman, Kelemen, & Young, 2014), and which is potentially relevant to the case of pain enjoyment on both grounds. Core disgust is considered to be based on adaptive responses to survival threats such as pathogens and disease vectors, while socio-moral disgust is considered to be a cultural product that functions to preserve shared social and cultural norms (Haidt et al., 1997). If pain enjoyment signifies a breach of socio-moral norms about pain itself, it may give rise to socio-moral disgust. In short, pain enjoyment may attract moral downgrading because it elicits disgust.

In sum, pain and pleasure arguably create a morally relevant affect state that would attract the moral judgement of others. Literature on socio-moral norms suggests that pain enjoyment is likely to be morally downgraded by others, and unconventionality and disgust provide two possible explanations.

The Current Studies

The present work investigates the moral status of pain enjoyment from the perspective of observers. With 2 studies, we aimed to empirically test whether pleasurable pain attracts a moral penalty from others. Participants were shown a vignette describing a person in a pain-enjoyment scenario, or a no-pain control (Study 1) or no-pleasure control (Study 2). Participants gave judgements about that person's moral character and proclivity to have moral thoughts and deeds, and rated whether they considered the behaviour of the target disgusting and unconventional. We predicted moral downgrading for pain enjoyment relative to controls, and tested unconventionality and disgust as mediators of this effect. In other words, pain enjoyment would be positively associated with observers' ratings of unconventionality and disgust, and that this would predict moral downgrading by observers.

Study 1

In Study 1, we presented participants with vignettes describing a person doing an activity bringing them enjoyment. We manipulated pain, with the target either in pain or not. In order to test whether pain enjoyment was morally downgraded relative to no-pain enjoyment, we then measured

moral judgments of that target person. We also tested perceived strangeness and disgust as potential mediators of the anticipated moral downgrading of pain enjoyment.

Method

Participants and Design

The sample consisted of 239 participants[5] (167 male; M_{age} = 31.52 years, *SD* = 9.18; 29.4% non-White) recruited through MTurk, with 92.5% reporting English as their first language. We used an experimental design with random allocation into two conditions (pain, no-pain). We manipulated pain by varying the level of pain described in the vignette, i.e. pain (*N* = 121) and no-pain (*N* = 118). Each participant was exposed to a single vignette item out of the eight possible vignettes per condition.

Procedure

Participants were recruited through MTurk, supplied with study information and asked for informed consent. Next each participant viewed a single vignette describing a person engaging in an activity they enjoy (described further in Materials and Measures below). In the pain condition, the activities were painful and the enjoyment specifically linked to painfulness. In the control condition, a comparable no-pain version of each activity was used. Then participants completed the moral judgements questionnaire by rating the morality of the person described in the vignette. Specifically, participants were asked to rate the person's proclivity to undertake moral or immoral actions; and their possession of moral traits (described in detail below). Finally, participants reported their demographic information (age, gender, preferred language, country of birth and ethnicity), and were then debriefed, thanked and paid for their time.

Materials and Measures

Enjoyment vignettes. Sixteen vignettes described a person taking part in an activity they enjoy. A total of eight target persons were described, each in a pain and no-pain version ('Briana', 'Michael', 'John', 'Amanda', 'Daniel', 'Brad', 'Desiree', and 'Rebecca'; see Table 1). In the pain condition, the person's activity was presented as painful and their enjoyment linked to painfulness.

Moral judgements. Moral judgments about the target were measured with 17 items concerning moral traits, thoughts and deeds (α_{total} = .93)[6].

Moral and immoral thoughts and deeds. Participants rated the likelihood that the person in the vignette would think or act in certain ways with eight items on a seven-point scale (from 1 – *Not*

[5] We aimed to collect 240 participants and closed access to the survey once this quota was exceeded. From a batch pool of 318 responses, we excluded 42 participant dropouts (with no responses on the variables of interest), and 37 participants for whom condition allocation was uncoded, leaving *N* = 239.

[6] Crohnbach's alpha for each target as follows, Briana: α = .92; Michael: α = .90; John: α = .95; Amanda: α = .95; Daniel: α = .93; Brad: α = .89; Desiree: α = .95; Rebecca: α = .93.

Table 1.

Vignettes describing the target person and activity with pain-liking and no-pain versions.

Target	Pain vignette	No-pain vignette
Briana	Briana liked to run until her muscles ached. She would make sure to run so far that she felt an almost unbearable burning soreness in her thigh muscles as she ran.	Briana liked to run until her muscles felt good. She would make sure that she ran far enough so she knew she was pushing her physical limits.
Michael	Michael enjoyed wrapping cotton around his index finger. He would pull the string tighter, watching the tip of his finger change color and feeling it throb.	Michael enjoyed wrapping cotton around his index finger. He would use the string to make different patterns, watching the tip of his finger until it was fully covered by the cotton.
John	John liked to wear an elastic band around his wrist to flick against his skin. He enjoyed pulling the elastic band taut and letting it go again, until his skin would smart.	John liked to wear a bracelet around his wrist. He liked how it would move around when he gestured and found that wearing it gave him a feeling of security.
Amanda	Amanda felt good pulling the skin away from her cuticles. Removing each loose end of skin gave her a flickering twinge of pain.	Amanda felt good pulling the skin away from her cuticles. Removing each loose end of skin made her hands look more feminine.
Daniel	Daniel liked to tap his bruised shins after a game of football. He liked the dull painfulness of the sensation in his legs, and would keep going until the feeling almost got too much.	Daniel liked to tap his bruised shins after a game of football. He liked the feeling of relief that this gave him, and would keep going until the feeling was no longer there.
Brad	Brad loved to eat hot chili and liked the stinging feeling on his tongue and lips. He would make sure the chili went directly onto his tongue to increase the sting, and would hold it there until he almost couldn't take it anymore.	Brad loved to eat hot chili and liked the sensation on his tongue and lips. He would make sure the chili went directly onto his food to increase the effectiveness, and continue to add chili until it was as hot as he could handle.
Desiree	Desiree enjoyed putting lemon juice on her finger if she got a papercut. She would stretch the edges of the cut to ensure that she could feel the lemon juice burning into her finger.	Desiree enjoyed putting lemon juice on her fingers if she touched something dirty. She would wipe the juice over her hand to ensure that any bacteria would be removed.
Rebecca	Rebecca sometimes liked to put her index finger into hot candle wax as it pooled beneath the candle flame. She would submerge her finger into the burning hot liquid, letting the burning sensation build up until she almost had to stop.	Rebecca sometimes liked to put her index finger into warm candle wax as it pooled beneath the candle flame. She would submerge her finger into the warm wax, letting the wax mold into different shapes.

at all likely to 7 – *Very likely*). Three items measured moral thoughts and deeds ('*Feel love and kindness towards others*, '*Feel concern for less fortunate others*', '*Give money to a charity*'), with five items measuring immoral thoughts and deeds ('*Have lustful thoughts*', '*Tell a lie*', '*Cheat others*', '*Become aggressive towards others*', '*Treat others unfairly*'), which were reverse scored.

Moral traits. We gauged moral traits with a measure based on the nine traits included the Self-Importance of Moral Identity Measure (Reed & Aquino, 2003). With nine items on a seven-point scale, participants rated the extent to which each moral trait (*caring*, *compassionate, fair, friendly*, *generous, helpful*, *hardworking*, *honest* and *kind*) described the person in the vignette (from 1 – *Not at all* to 7 – *Very much so*).

To quantify disgust and strangeness, participants gave normative judgments about the person's behaviour. We asked participants to rate whether the person's behavior was strange ('*How normal do you think this behavior is?*', from 1 – *Very normal* to 7 – *Very strange*; shared by others: '*How many people do you think share enjoyment of this experience?*', from 1 – *Very few* to 7 – *Almost everyone*)[7]; and disgusting: ('*How disgusting do you think this behavior is?*', from 1 – *Not at all* to 7 – *Very much so*).

Results

Independent-groups *t*-tests revealed a consistent pattern of differences between the pain and no-pain conditions (see Table 2, Figure 1). We found that pain-likers received lower moral judgements (M = 3.89, SD = .94) than the no-pain control (M = 4.15, SD = .96; $t(237) = -3.58$, $p < .000$, 95% CI_{diff} [-.6789, -.1971], d = 0.46). Specifically, pain-likers were considered less likely to undertake moral thoughts and deeds (M = 4.15, SD = 1.20) than the control condition (M = 4.55, SD = 1.03; $t(237) = -2.81$, p = .005, 95% CI_{diff} [-.6934, -.1220], d = 0.36), and were seen as more likely to undertake immoral thoughts and deeds (M = 4.58, SD = 1.06) than control vignettes (M = 4.01, SD = 1.11, $t(237) = 4.02$, $p < .000$, 95% CI_{diff} [.2872, .8395], d = .53). Pain likers were also considered lower in moral traits (M = 4.07, SD = 1.17) than the no-pain analogues (M = 4.45, SD = 1.19, $t(237) = -2.45$, p = .014, 95% CI_{diff} [-.6795, -.0774], d = .32).

[7] Spearman-Brown's rho (Eisinga, Grotenhuis, & Pelzer, 2013) for each target as follows, Briana: ρ = .32; Michael: ρ = .44; John: ρ = .77; Amanda: ρ = .66; Daniel: ρ = .59; Brad: ρ = .78; Desiree: ρ = .30; Rebecca: ρ = .78.

Table 2.

Descriptive statistics and significance testing for morality variables.

	M (SD)				*t*	*p*	*d*
	Pain		No-pain				
Moral judgement	3.89	(.94)	4.33	(.96)	-3.58	.000	.46
Moral thoughts and deeds	4.15	(1.20)	4.55	(1.03)	-2.81	.005	.36
Immoral thoughts and deeds	4.58	(1.06)	4.01	(1.11)	4.02	.000	.53
Moral traits	4.07	(1.17)	4.45	(1.19)	-2.45	.014	.32
Unconventional	4.44	(1.49)	5.10	(1.27)	3.70	.000	.48
Disgusting	3.26	(1.90)	2.48	(1.73)	3.28	.001	.43

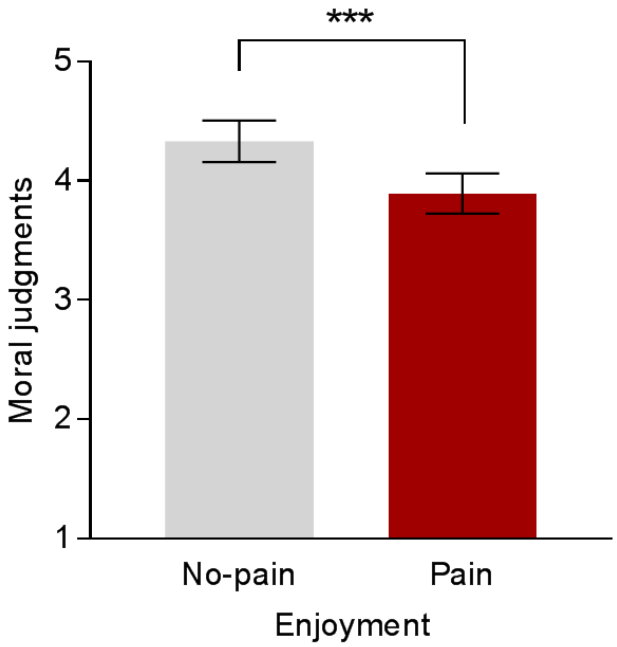

Figure 1. Moral judgements of pain and no-pain enjoyment. Error bars represent 95% confidence interval. Higher scores on moral judgments indicate more favourable ratings.

We then tested the mediators of *disgusting* and *unconventional* with the PROCESS macro (Model 4) with 5000 bootstrapped samples (see Figure 2). We tested a model in which disgusting and unconventional served as parallel mediators of the relationship between pain enjoyment (predictor) and moral judgments (outcome; Hayes & Preacher, 2013). For clarity, we reverse-scored moral judgements so that the dependent variable would represent moral downgrading. These analyses showed significant indirect effects via disgusting (*IE* = .087, SE = .0602, 95% CI [.0323, .1811]) and unconventional (*IE* = .2091, SE = .0367, 95% CI [.1032, .3400]).

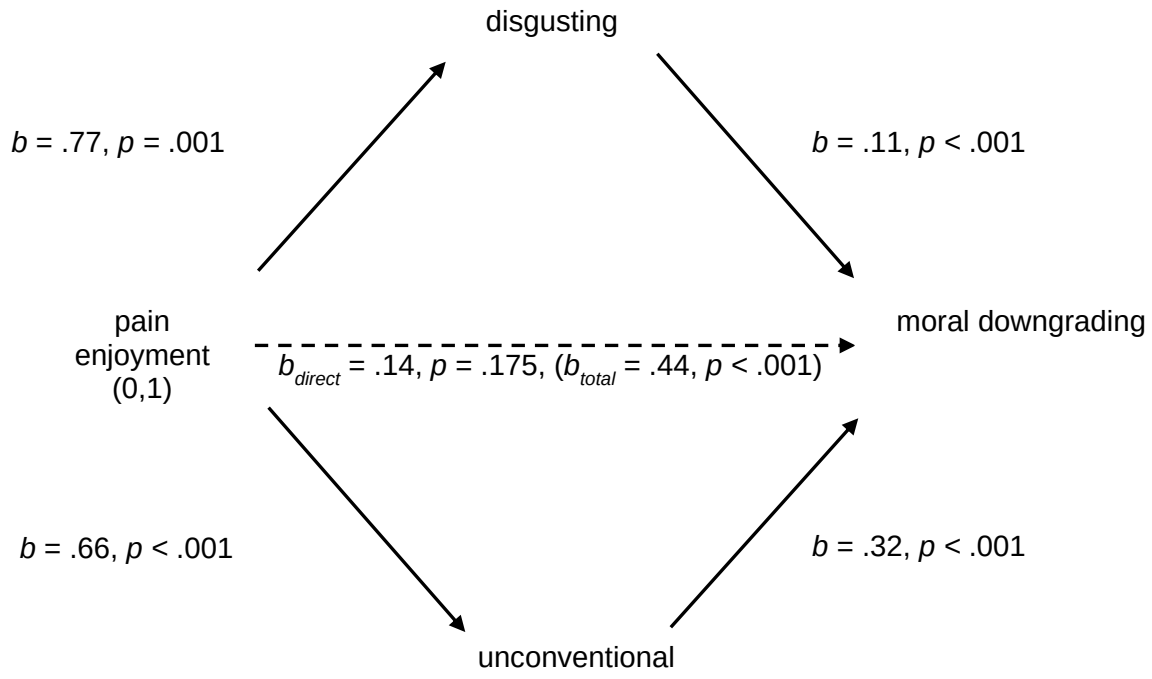

Figure 2. Process model showing a parallel indirect effect of pain enjoyment on moral downgrading via disgusting and unconventional. Index of parallel mediation = .2961, SE = .0724, CI [.1613, .4480], R^2 = .36.

In sum, Study 1 provided evidence that pain likers were seen as less moral and more immoral; and their behaviour as more unconventional, transgressive and disgusting, compared to a no-pain counterpart. Mediation analyses suggest that moral downgrading was explained by pain enjoyment being both disgusting *and* unconventional.

However, because of the varied nature of vignette scenarios and targets across conditions (i.e. differences between scenarios not related to pain and enjoyment specifically), it was not possible to rule out whether these effects were artefactual to this set of vignettes themselves or specific to pain enjoyment. We therefore sought to conceptually replicate and extend these findings with Study 2, in which we provided more tightly controlled vignettes, and manipulated enjoyment while keeping pain constant.

Study 2

In Study 2, we again presented participants with vignettes describing a single person experiencing pain. We provided vignettes that comprised fewer scenarios and which were more tightly comparable across conditions – getting a tattoo and going to the dentist. We held pain constant and manipulated enjoyment. We also included a neutral condition to provide a more conservative test of the pain enjoyment effect, with the target person either enjoying, neutral or

disliking the pain. We then measured moral judgments of that target person, in order to test whether pain enjoyment was morally downgraded relative to disliking pain and neutral pain.

Method

Participants and Design

The sample comprised 312 participants[8] (166 male, M_{age} = 33.65 years, 59% non-white) recruited through MTurk, with 87% reporting English as their first language. We used a 3x2 experimental design and manipulated enjoyment (three conditions, liking: N = 107, neutral: N = 101, and disliking: N = 104); and activity (two conditions, tattoo: N = 157, or dental procedure: N = 155). Each participant was randomly allocated to condition and exposed to a single vignette of a person experiencing pain and their liking, neutrality, or disliking with regard to the experience.

Procedure, Materials and Measures

As for Study 1, participants were recruited through MTurk, provided with study information, and invited to give informed consent. Each participant viewed a single vignette describing a person engaging in the painful activity (described below). Then participants were asked to complete the morality judgements questionnaire. Finally, participants reported their demographic information, and were debriefed, thanked and paid for their time.

Vignettes. Each participant viewed a pain vignette describing a person 'Jennifer' engaging in a painful activity that is relatively common (either getting a tattoo or having a dental procedure). Jennifer subsequently rated the activity as very painful (i.e. at 9 out of 10, where 10 means 'extremely painful'; see Table 3). Numerically providing the pain rating provided a more clearly defined manifestation of pain than in Study 1. The three enjoyment conditions (dislike, neutral, like) were also introduced via a rating from Jennifer (i.e. a 1 out of 10, where 1 means 'I disliked it very much'; see Table 3). Again, numerically stating the enjoyment rating made it clear precisely how much enjoyment the target was experiencing.

Moral judgements. Moral judgments about the target person were measured with 17 items concerning moral traits, thoughts and deeds (as described for Study 1 earlier; dental procedure: α = .91; tattoo: α = .91;). In a similar approach to Study 1, in order to measure mediators of unconventionality and disgust, participants also rated how strange was Jennifer as a person, how strange was her behaviour, and how many other people would also like/ feel neutral about/ dislike the experience (dental: α = .84; tattoo: α = .78); as well as how disgusting was the particular response to the experience.

[8]We aimed to collect 300 participants and closed access to the survey once this quota was exceeded. From a batch pool of 325 responses, we excluded 13 participant dropouts (with no responses on the variables of interest), leaving N = 312.

Table 3.

Vignettes describing a painful experience in pain-liking, pain-neutral and pain-disliking conditions.

Pain experience	Like	Neutral	Dislike
Jennifer is [having a dental procedure/ getting a tattoo.] During the process she experiences a lot of pain, rating her pain as a 9 out of 10, where 10 means 'extremely painful'.	When asked to indicate how she felt about the pain, she said that she enjoyed it. She rated her liking for the pain as a 9 out of 10, where 10 means "I liked it very much".	When asked to indicate how she felt about the pain, she said that she felt neutral about it. She rated her liking for the pain as a 5 out of 10, where 5 means "I neither liked it or disliked it".	When asked to indicate how she felt about the pain, she said that she did not enjoy it. She rated her liking for the pain as a 1 out of 10, where 1 means "I disliked it very much".

Results

The data were analysed with a two-way ANOVA, with enjoyment (liking, neutral, disliking) and activity (dental, tattoo) as independent variables, and moral judgments as the outcome variable. This revealed a significant main effect of enjoyment on moral judgments, $F(2, 306) = 11.23$, $p < .000$, $\eta^2_p = .07$ (see Figure 3). There was no main effect of activity, $F(2, 306) = .59$, *ns*, nor any significant pain by vignette interaction, $F(2, 306) = .82$, *ns*. Simple comparisons revealed that pain enjoyment attracted significantly lower moral judgements ($M = 4.02$, $SD = 1.03$) than neutrality ($M = 4.37$, $SD = .86$; 95% CI_{diff} [-.649, -.042]) and significantly lower moral judgements than disliking ($M = 4.61$, $SD = .82$; 95% CI_{diff} [-.892, -.289]). There was no significant difference in moral judgements between the neutral and disliking conditions.

We again tested the mediators of *disgusting* and *unconventional* with the PROCESS macro (Model 4) with 5000 bootstrapped samples (see Figure 4). We tested the same model as for Study 1 in which disgusting and unconventional served as parallel mediators of the relationship between pain enjoyment (predictor) and moral downgrading (outcome). This again showed significant indirect effects via disgusting (*IE* = .081, SE = .0285, 95% CI [.1199, .2852]) and unconventional (*IE* = .1111, SE = .0421, 95% CI [.0334, .2014]).

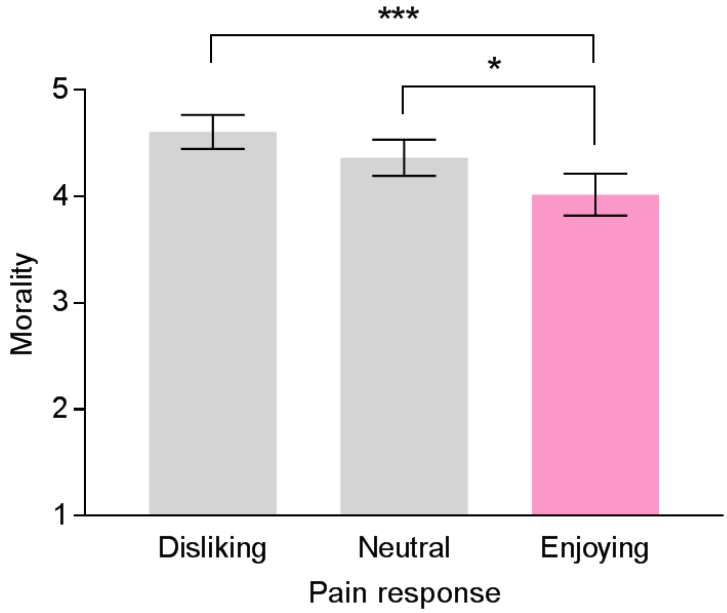

Figure 3. Moral judgements of pain and no-pain enjoyment. Error bars represent 95% confidence interval. Higher scores on moral judgments indicate more favourable ratings.

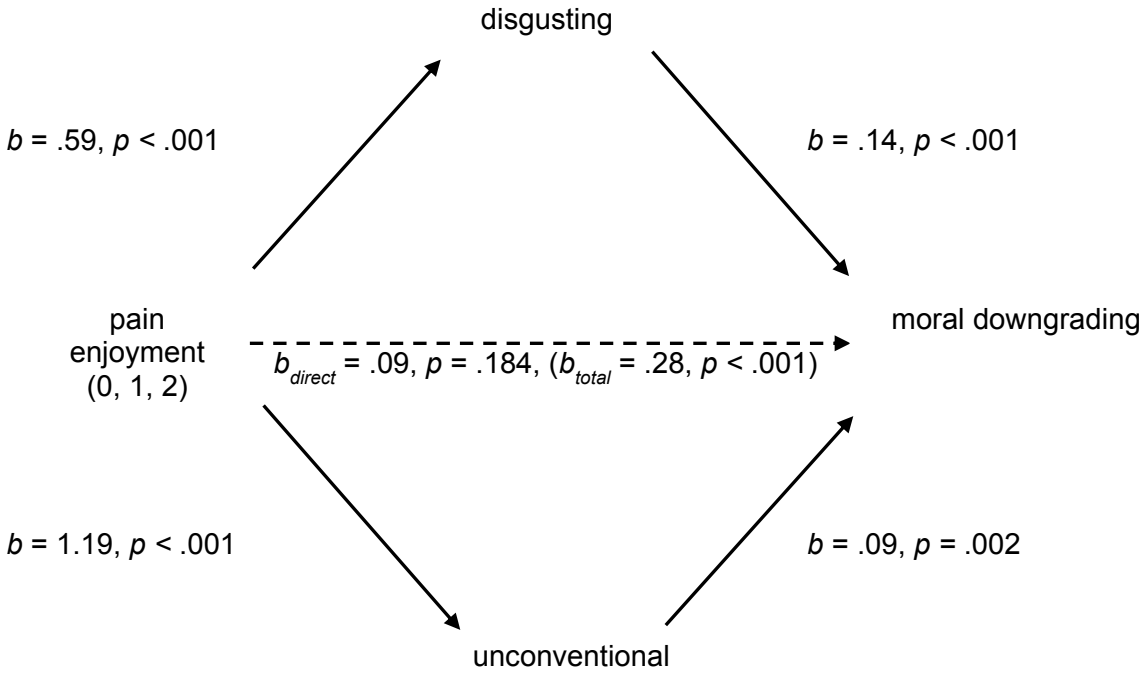

Figure 4. Process model showing a parallel indirect effect of pain enjoyment on moral downgrading via disgusting and unconventional. Index of parallel mediation = .1922, SE = .0418, CI [.1199, .2852], R^2 = .18.

In sum, Study 2 provided further evidence that pain likers were seen as less moral and more immoral; and their behaviour as more unconventional, and disgusting, compared to a pain-disliking and neutral counterpart. Mediation analyses again suggested that moral downgrading was explained by pain enjoyment being both disgusting *and* unconventional.

General Discussion

In two studies, we examined the moral status of pain enjoyment. Both studies showed that pain enjoyment elicits a moral downgrading from observers, relative to people who are experiencing enjoyment without pain (Study 1) and pain without enjoyment (Study 2). Targets experiencing pleasure and pain were consistently judged by observers to be less moral, and more immoral, in traits, thoughts and behaviours compared to no-pain and no-enjoyment comparison conditions. Therefore, it appears that pain enjoyment is morally diagnostic, and attracts moral downgrading from others.

This research makes a straightforward contribution to the literature by providing empirical evidence of moral judgements concerning pain enjoyment. Enjoying pain has been represented as pathological (American Psychiatric Association, 1987; Freud, 1929), and where careful examinations of pain enjoyment have emerged, these have tended toward a more prurient focus (Baumeister, 1988, 1989/2014). More recently, descriptive assays of pain and pleasure in sporting contexts and in popular culture have added descriptive depth to this phenomenon (Allen, 2003; Bridel, 2010; Gard & Meyenn, 2000). However, experimental research into the moral status of pain enjoyment was lacking. This work has aimed to fill this gap in the literature and provide a reasoned foundation for future research on moral judgements of pain enjoyment across a wider spectrum of human endeavour than sexual contexts.

The aims of the present work were also to examine moral judgments associated with pain and pleasure by investigating two possible mediators. We found that disgust and unconventionality mediated the relationship between pain enjoyment and moral downgrading. This suggests that pain enjoyment violates socio-moral norms and elicits socio-moral disgust, which in turn explains the moral downgrading effect. Relevantly to instances of pain, it may be that some forms of pain enjoyment also elicit core disgust. This could be particularly relevant for those examples of pain enjoyment involving self-directed violations of the body envelope, such as piercing of the skin, which also carry salient cues of disease risk (Oaten, Stevenson, & Case, 2009). However, not all pain involves a specific breach of the body envelope; and in the absence of such a breach, socio-moral norms concerning pain provide a more parsimonious account of the moral downgrading effect across the various examples of painful activity. Moreover, *enjoying* such an experience could heighten perceptions of disgust because enjoyment provides the observer confirmatory evidence about the target individual's specific preferences and proclivities – more than simply undertaking

the pain-inducing act itself. Future research could valuably tease apart these distinctions by making direct comparisons between the two types of pain induction.

It is worthwhile to note that pain enjoyment can be experienced within the normal spectrum of human behaviours that are below a clinical threshold. In more extreme forms, enjoying pain may attract associations with pain-seeking manifestations of distress or mental ill health, such as non-suicidal self injury (Franklin, Lee, et al., 2013; Franklin, Puzia, et al., 2013; Nock, 2009; Selby, Nock, & Kranzler, 2014). Importantly, pain-seeking is different to pain enjoyment. Nevertheless, against this backdrop, more banal forms of enjoying pain may seem 'dangerous territory' (Gard & Meyenn, 2000, p. 19): an experience relegated to the territory of subcultures (Bridel, 2010), pertaining to sexual deviance, or simply not for mainstream consumption (cf Joyal & Carpentier, 2017).

With this in mind, the present research also provides a reflective counterpoint to the growing literature on the positives of pain (Bastian, Jetten, Hornsey, et al., 2014). There is increasing evidence in support of the positive consequences of pain in many circumstances – *shared* pain can bring people together, by enabling collective connection, identification and meaning-making (Bastian, Jetten, & Ferris, 2014; Ferris, Jetten, Johnstone, et al., 2016; Vezzali et al., 2015). However, in a non-collective context, the current work shows how observers can interpret those experiences when enjoyment co-occurs, and specifically that pain enjoyment results in moral downgrading from others.

The moral downgrading effect has been observed despite evidence of everyday benign masochism being normative (Rozin et al., 2013), and evidence that pain and pleasure together can be beneficial in facilitating identity expression and social identification (Ferris et al., manuscript in preparation). Notably, these benefits appear to emerge when pleasure and pain are experienced in collective contexts. Further research should, in the first instance, seek to determine whether these findings replicate in collective settings, or whether the collective context extinguishes the moral downgrading effect. From a functional perspective, finding pleasure in pain could allow people to maximise pleasure or potentiate future savouring (Croft, Dunn, & Quoidbach, 2014); to derive 'silver linings' or build a growth narrative from past pain that informs future pain experiences – such as in the example of personal challenge experiences like 'Tough Mudder' (Scott et al., 2017). Future research could therefore examine when and why pain and pleasure may be normative within social or cultural scaffolds, and examine how these experiences may become normative over time.

The present research also adds to previous investigations into the moral status of mixed affective experiences overall. Past research has investigated enjoyment of others' pain, such as schadenfreude and sadism (Buckels, Jones, & Paulhus, 2013; Cikara & Fiske, 2013; Gromet, Goodwin, & Goodman, 2016; Smith et al., 1996), but there has been less focus on observer

judgements of *own*-pain enjoyment, particularly non-sexual pain. These studies therefore provide a basis for further examination of the moral status of pain enjoyment, and identification of moral judgments that other mixed affective states may garner (Larsen et al., 2004; Rozin et al., 2013). Future research should examine whether the moral downgrading effect carries for other forms of benign masochism, or whether pain enjoyment represents a special case.

Conclusion

Utilitarian philosophers have long suggested that pleasure and pain each carry instructive moral value, where these internal experiences and their sequelae can help us know right from wrong. Bentham (1789/1907) was explicit in this view when he declared that '[n]ature has placed mankind under the governance of two sovereign masters, pain and pleasure. It is for them alone to point out what we ought to do, as well as to determine what we shall do'. If we do seek to maximise pleasure, then finding pleasure in aversive places seems one way to do so. However, it appears that pain and pleasure together are morally diagnostic for observers, and a stable moral downgrading effect is incurred as a result of these affective states being seen as unconventional, and disgusting.

Chapter 6

General Discussion

The aim of this thesis has been to advance a social psychology of pain. Pain is a seminal human experience with clear evolutionary value in signalling threats to survival (A. D. Craig, 2003b); with positive as well as negative psychological consequences (Bastian, Jetten, Hornsey, et al., 2014); and with diverse sociocultural meanings (Aldrich & Eccleston, 2000; Glucklich, 2003). Viewing pain as more than mere nociception, this thesis has broached new territory in what pain is and how it functions, informed by a biopsychosocial understanding of pain (Engel, 1977). Such an approach has generated fresh lines of enquiry, with novel theoretical and empirical research along four specific themes: a new synthesis of pain overlap and its conceptual boundaries; examination of how social groups can modulate pain communication and experience; investigation of the psychological and social sequelae of pain and pleasure in the context of a mass gathering; and experimental evidence of third party morality judgments associated with pain enjoyment. In short, this work has contributed to the advancement of pain research by advocating what may be gained from a focus on the psychosocial understanding of pain (Chapter 2), and through considered implementation of a biopsychosocial approach to pain (Chapters 3-5).

Summary of Findings and Implications

In detail, Chapter 1 provided an introduction to current pain research, and situated the work of this thesis within the relevant pain literature to date. The following Chapters proceeded as four integrated but discrete lines of research into the social psychology of pain.

Chapter 2 focused on the overlap of social and physical pain. A critical review and analysis of the literature on pain overlap was undertaken (Ferris, Jetten, Hornsey, & Bastian, manuscript in revision). This chapter presented a theoretical analysis of the posited overlap between social and physical pain, and set out a new synthesis of pain overlap and social pain theory (Eisenberger, 2015; Eisenberger, Lieberman, & Williams, 2003; MacDonald & Leary, 2005). In reflecting on the preponderance of evidence ruling in or out the existence of neural overlap, a return to further examination of the psychosocial components of pain was proposed. Put simply, theoretical integration on the basis of biological (neural or physiological) similarities may gloss over important differences in psychological and social aspects of these phenomena. A broken heart is not truly broken. The psychosocial aspects of social and physical pain provide us with a framework for interrogating and understanding the value of similarities; and for identifying the substance of differences in terms of antecedents, cognitions and emotions surrounding pain, and sociobehavioural consequences.

The remaining Chapters formed the empirical contribution of this thesis. Chapter 3 embarked on an empirical examination of how social context can impact pain – specifically, how

salient group memberships modulate the experience and communication of pain (Ferris, Jetten, Molenberghs, Bastian, & Karnadewi, 2016). This chapter presented the findings of an fMRI and behavioural study in which participants experienced pain while thinking of valued social group memberships in the scanner. This showed that participants increased their pain reports when more of their own social group memberships were salient – suggesting that an increase in salient groups can facilitate pain reporting. When examining behavioural and brain activation results in tandem, the data showed that as participants escalated their pain reports as groups increased, there was a relative reduction in activation in regions of interest associated with pain (left and right insula and dorsal anterior cingulate cortex). This implicates pain communication as an adaptive response to pain as salient social resources change, and shows how biological and psychological indices of pain can be modulated by psychosocial variables such as group salience. This Chapter also highlighted the broader theme of a biopsychosocial approach to pain: that thinking about pain in biological, psychological and social terms allows us to test hypotheses across these domains to reveal new insights about how pain operates.

While Chapter 3 examined the impact of groups on pain, Chapter 4 investigated the impact of pain experienced in the collective – how painful activities can bind people together. Chapter 4 brought the enterprise into the field with a pre-post survey of adults undertaking an *en masse* midwinter dawn swim. This study examined pain alongside pleasure, and tested a candidate psychological mechanism (self-revelation) for the psychosocial benefits of such activities. Consistent with previous research on shared pain (Bastian, Jetten, & Ferris, 2014; Xygalatas et al., 2013), results showed a significant increase in social identification over the course of the swim, such that participants felt more bonded and identified more strongly with others after sharing this collective activity. Underlying this finding, we found increased trust and social connection with other swimmers, and identification with other swimmers as well as the overall festival including non-swimmers. We also found that participants experienced a greater sense of self-revelation following the swim, and most importantly, that this effect was most strongly evident for those reporting high levels of pleasure and pain from the swim.

Contrary to prior research into sexual masochism, pain and enjoyment revealed the self, rather than allowing escape from or annihilation of the self. More broadly, this Chapter also highlighted the value of undertaking empirical investigations outside the laboratory to contextualise psychosocial investigations with rich ecological validity. These *in vivo* contexts allow social psychology researchers to combine the benefits of empirical research with settings traditionally associated with qualitative disciplines such as sociology and anthropology. Particularly for social psychologists, this means we can examine psychosocial phenomena ‘in the wild’, where biological, psychological and social intersect, such as the collective experience of pain and pleasure *en masse*.

Building on the findings of Chapter 4, the next Chapter investigated how others perceive pain enjoyment in terms of moral judgments. Chapter 5 presented experimental evidence on third-party moral judgments about pain and enjoyment. Across two studies involving large online samples, targets who showed pain enjoyment were consistently judged less moral and more immoral than no-pain or no-enjoyment controls. These studies showed that in accessing the psychosocial dividends available from shared pain and enjoyment (i.e. those demonstrated in Chapter 4), people also need to be wary of observers' moral judgements and the potential for moral downgrading. Qualitative evidence has documented the impoverished moral status of pain enjoyment, but this Chapter is the first to provide empirical substantiation and to test potential mediators of unconventionality and disgust. Given the mediating roles for unconventionality and disgust identified in this thesis, pain liking presents an excellent candidate to test a range of relevant hypotheses in future moral psychology research. In further linking to the broader themes of this thesis, this Chapter also completes the circle in terms of elaborating the perspective of the observer, which forms part of the social context in which pain experiences may occur – an important ingredient in a biopsychosocial understanding of pain. The Chapter examined observers' judgements about *solitary* experiences of pain and enjoyment, but the socio-cultural scaffold of collective experiences may well extinguish this moral downgrading effect.

Altogether, the present thesis has provided a new roadmap for examining social and physical pain overlap; and across 3 empirical chapters, has examined pain communication, identification following shared pain, and moral judgments associated with enjoying pain across laboratory, field, and online settings. Within the context of existing literature, this thesis belongs within the tradition of other works that have invoked a contextualised, i.e. biopsychosocial approach to pain (Morris, 1991). The aim has been to continue consistently within this tradition, and to thoughtfully extend on the groundwork that has already been laid. Evidently, the frontiers of pain research lie not only in the assessment and treatment of pain pathologies, but also in tracing the pain that attends our non-medical lives – the banal pains, the everyday or occasional pains, the shared pains, or the subclinical pains.

These pains are also worthy of scientific understanding, and this thesis has aimed to include them within its reach. In other words, this thesis contributes to what might be referred to as a normal psychology of pain, in which pain is accepted as valid, diverse, and part of living.

Limitations and Future Directions

Overall, this thesis has expounded an investigation into the experience of pain, bound together by a commitment to the biopsychosocial approach and its application. Each chapter has already delineated some of the constraints, shortcomings and future directions emerging from the

work described therein. Therefore the aim of the following passages is to briefly set out some overarching points of broader relevance.

For instance, Chapter 2 was a theoretical chapter reviewing the literature on physical and social pain overlap theory, and offering a new synthesis of the relationship between physical and social pain. On the surface, this chapter may be seen as a critique of the use of biological indices altogether. To the contrary, this work advocates the utilisation of all scientific means of understanding pain, including neural, biological and psychophysiological. What it argues against is the use of evidence of biological overlap as a basis for the descriptive recategorisation of constructs that are multidimensional – *i.e.* bio*psychosocial*. Each pain has unique features that are fundamental to its operation, and overlap analysis can be undertaken and begun with a biopsychosocial perspective front of mind, in order to properly investigate these phenomena along the full range of dimensions for investigation presently available to science. Rather presciently, William James considered that refutations of the boundaries between various emotions and their 'shadings' to be overly descriptive and unprofitable; '[a]nd not only is it tedious, but you feel that its subdivisions are to a great extent either fictitious or unimportant, and that its pretences to accuracy are a sham' (James, 1892/2001, p. 242).

However, by unpacking the antecedents, cognitions, and emotions that are associated with each pain, the question of overlap versus difference can be better understood. This brings the focus away from description and back to function, just as originally proposed by James himself. Therefore, Chapter 2 provides a roadmap for how such an approach can be implemented and expanded to support the considered analysis such states.

Turning to Chapter 3, this study provides experimental evidence of an adaptive response to pain linked to changes in salient social groups in a laboratory setting. Pain is inevitable; therefore, understanding how valued groups can help group members to endure and support others' pain is important. If valued groups allow us to broadcast our pain, the effectiveness of these pain messages in eliciting support is a logical next step. Research into pain catastrophisation has shown there can be negative psychosocial consequences to magnifying and ruminating on our pain (Sullivan, 2012; Sullivan et al., 1995), including increased risk of pain chronicity. Following replication, there may be value in extending this research into ecologically valid settings outside the laboratory. Although more extensive clinical applications are beyond the scope of this thesis, consultation with carer and pain services consumer groups would be an important component of further developments to enable clinical applications of this work to be realised to support consumers and caregivers.

Chapter 4 takes the literature on shared pain forward by incorporating measurement of pleasure. These data support self-revelation as a candidate mechanism for increased social bonding from intense affective experiences i.e. pleasurable pain fostered more social identification because

participants felt more firmly that they had revealed something about who they are. Due to the brevity of our measurement techniques however, there is low resolution in terms of the content of the 'self-revelation' construct. Fleshing out this psychological construct will allow us to understand what precisely was being revealed and to what end – was it revelation of penumbral psychological or bodily mastery (as suggested by Fredrickson, 2000; Klein, 2014; Rozin et al., 2013); or authenticity, vulnerability, or values (Rossano, 2012; Watson-Jones & Legare, 2016)? The content of these revelations cannot be determined with the present data. Therefore, follow up studies with festival collectives are planned in order to examine the reproducibility of our findings against the backdrop of the extant literature; to elaborate on the substance of the mediator variable of self-revelation with the addition of more items targeting this construct; and to more robustly test our posited predictors of pain and pleasure with the added veracity of a comparison group. The value of a comparison group is to implement a quasi-experimental design, which would provide more variance in measures of interest, and furnish us with grounds to make a stronger case for causal inferences than repeated measures data (noting the inherent limitations of quasi-experimental design, such as non-random allocation to groups).

Chapter 5 provided reproducible evidence of the moral downgrading of pain enjoyment, and invites further investigation of how others regard this phenomenon from a moral standpoint. The present set of studies identify unconventionality and disgust as mediators to explain why pain enjoyment is morally diagnostic (Gray & Keeney, 2015). These studies responded to the identified need for experimental evidence of the basic phenomenon of moral downgrading of pain enjoyment by onlookers; and the design of this series of experiments removed the potentially confounding contribution of specific social or cultural settings, given that the focus was on pain and enjoyment in solitary situations. Nevertheless, orienting to social and cultural settings provides ecological validity, and contextualises pain consistent with the biopsychosocial approach espoused within this thesis. Social context would indeed be an appropriate variable to manipulate formally in future research – for instance to test whether the moral downgrading effect holds for collective pain enjoyment in which social information is provided. For example, to specifically determine whether sharing pain enjoyment extinguishes moral downgrading; or alternatively, whether enjoyment of costly signalling activities (such as religious practices, painful mass gatherings etc.) undermines the perceived value of costly behaviours in the eyes of third party observers; and whether this explains the moral downgrading effect of pain enjoyment.

Ultimately, the findings from Chapter 4 suggest that there are positives to be found in collective pain and enjoyment; yet Chapter 5 highlights the need for caution in light of the potential for moral downgrading by others. This is consistent with other research documenting Western societies' at times fraught relationship with pleasure and pain (Allen, 2003; Halttunen, 1995), and

the associated stigma linked with pain enjoyment in sexual domains (Baumeister, 1988, 1989/2014) despite its prevalence (Joyal & Carpentier, 2017). This indicates that there may be significant social barriers for individuals in pain to access alternative narratives and cognitive frames for their suffering, particularly involving pleasure (Aldrich & Eccleston, 2000). As noted, the question of whether moral downgrading occurs in collective contexts is therefore an important avenue for future research.

More broadly, as technological advancements proceed, we can expect pain research to not only look closer, but also step back to take in the bigger picture. In addition to high-resolution discoveries of nociceptor characterisation (e.g., Julius & Basbaum, 2001) and functional description of pathways and neural networks associated with pain (C. R. Chapman, Tuckett, & Song, 2008; Price, 2000; Wager et al., 2013; Wager et al., 2004; Woo et al., 2014), substantial research has expanded on the psychological and social underpinnings of pain, including delineation of sensory and affective components of pain (Fernandez & Turk, 1992); extensive elaboration of psychological antecedents, modulators, and consequences of pain (e.g., Krahe, Springer, Weinman, & Fotopoulou, 2013; Price, Hirsh, & Robinson, 2008; Riva et al., 2011; Sullivan, 2012; Sullivan et al., 1995; Tracey, 2010). This thesis has brought together the lessons from prior work and set them forth into new directions, in the hope of meaningfully progressing our understanding of pain.

Conclusions

Pain is ubiquitous, complex, and yet beguilingly simple. Understanding the role of pain in people's lives is an ongoing human endeavour, and critical territory for social psychology alongside other disciplines. This thesis has made a contribution to knowledge about how pain functions as a part of the human condition, within social contexts and in tandem with pleasure. This thesis belongs within a broader tradition of pain research in which this subjective experience is seen as more than purely medical or physiological – and rather, as a bio*psychosocial* phenomenon. Alongside this thesis, more and more research now focuses on the social side of the pain equation (Bastian, Jetten, & Ferris, 2014; Ferris, Jetten, Johnstone, et al., 2016; Jones & Jetten, 2011; Xygalatas et al., 2013). Pain indelibly mars the lives of acute and chronic sufferers, but it also takes place in non-clinical populations and outside medical settings, which is also deserving of scientific inquiry. Social psychology has an important role in the broader scientific efforts toward understanding pain, with its broad levels of analysis providing the theoretical and empirical tools to measure how social context deeply informs what pain is and how it functions.

Pain can be relieved, exacerbated, tolerated, catastrophised. It may seem senseless and cruel, lonely, unspeakable; or be cherished for what it represents, and its capacity to cut through our differences and bring us together. There are times when it seems pain will always confound us – at

the end of it, making sense of pain is all that we may ask of ourselves. In modest ways, this thesis has offered some inroads and new paths toward making sense of pain.

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Appendices

Appendix A

Chapter 3 Data Availability Statement

Data files for Chapter 4 are available from the Open Science Framework database at http://osf.io/ejxvs

Appendix B

Chapter 4 Supplementary Materials

Pre- and post-event questionnaires measured additional variables not reported earlier for brevity. These include 2 items relating to similarity and connection with animals (Amiot & Bastian, 2015, 2017); 2 pictorial items relating to identity fusion with other swimmers at the festival (Swann et al., 2009; Swann et al., 2012); 2 items on self-esteem and meaningful existence (I feel good about myself; My existence is meaningful) related to fundamental psychological needs (K. D. Williams, 2007b); and 1 item on how much participation in the event allowed the participant to 'get back to basics'.

Supplementary Table 1.

Pre- and post-event descriptive statistics, paired t-test outcomes, and effect size

	M (SD)							
	Pre-event		Post-event		*t*	*p*	95% CI_{diff}	*d*
Animal connection	4.69	(1.78)	4.79	(1.81)	1.13	.260	[-.077, .283]	-.08
Animal similarity	4.83	(1.43)	4.88	(1.79)	0.67	.505	[-.101, .205]	-.05
Identity fusion with swimmers	3.19	(1.23)	3.74	(1.12)	7.23	<.001	[.398, .696]	.53
Identity fusion with festival	2.93	(1.12)	3.17	(1.05)	3.62	<.001	[.110, .374]	.26
Self-esteem	5.74	(1.30)	6.27	(1.01)	6.25	<.001	[.363, .699]	.46
Meaningful existence	5.69	(1.43)	5.92	(1.36)	3.06	.003	[.084, .390]	.21
Back to basics	4.93	(1.87)	5.45	(1.62)	4.70	<.001	[.299, .732]	.35